DOCUMENT RESUME

ED 270 917 EC 182 914

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TITLE Maternal Attributions of Communication in Dyads with Handicapped and Nonhandicapped 11-Month-Olds. Final Report.
INSTITUTION North Carolina Univ., Chapel Hill. Frank Porter Graham Center.
SPONS AGENCY Special Education Programs (ED/OSERS), Washington, DC.
PUB DATE Aug 85
GRANT 300-82-0366; G008430019
NOTE 167p.; Ph.D. Dissertation, University of North Carolina at Chapel Hill.
PUB TYPE Dissertations/Theses - Doctoral Dissertations (041) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS Attribution Theory; *Communication Skills; *Disabilities; Infants; *Interaction; *Mothers; *Parent Child Relationship

ABSTRACT

The frequency and nature of maternal attributions of communication in dyads with 16 11-month old handicapped infants were examined. For some aspects of the study the experimental group was compared with a control group of 16 dyads in which the same-age infants were not handicapped. The study addressed four major purposes: (1) to compare groups on the frequency of maternal attributions of communication; (2) to compare explanatory models for within-group variance on frequency of maternal attributions; (3) to test the relation of infant and maternal factors on the types of behavior that mothers of handicapped children called communicative; and (4) to describe the maternal elicitations and responses to those behaviors. Structured assessment procedures and behavioral coding of free play sessions were used in two studies. Among results were indication of group differences in the total occurrence of three of four potentially communicative infant behaviors; no group difference in the frequency of maternal attributions of communication; a positive within-handicapped sample relation between degree of handicap and maternal tendency to attribute; and a positive within-handicapped sample relation between degree of handicap and maternal responsiveness to communicative behaviors. Results challenge the assumption that mothers of handicapped children respond less frequently to their infants than do other mothers. (CL)

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Maternal Attributions of Communication in Dyads with Handicapped and Nonhandicapped 11-Month-Olds.

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Division of Special Education

Paul Jordan Yoder

Chapel Hill, N.C.

August, 1985

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This research was funded by, but does not necessarily reflect the opinions of, the Department of Education, Special Educational Programs (#G008430019 and #300-82-0366).

EC 182 914

PAUL YODER. Maternal Attributions of Communication in Dyads with Handicapped and Nonhandicapped 11-Month-Olds (Under the direction of LYNNE FEAGANS).

The literature has suggested that maternal attributions of communication may motivate mothers to respond to their babies' behavior contingently. This contingent responding affects the nature of mother-infant engagements and may facilitate infant development. Some researchers have suggested that mothers of handicapped infants respond to their infants' behavior less frequently than other mothers. One explanation for these differences has been the assertion that handicapped children give their mothers fewer communicative cues.

The present study addressed several questions about the frequency and nature of maternal attributions of communication in dyads with 11 month old handicapped infants (n = 16). Although a sample of dyads with chronological age matched peers without handicaps (n = 16) was included for comparison, the main thrust of the study was to investigate the relation of variables within the handicapped group. The purposes of the study were a) to compare groups on the frequency of maternal attributions of communication, b) to compare explanatory models for within-group variance on frequency of maternal attributions, c) to test the relation of infant and maternal factors on the types of behaviors that mothers of handicapped children called communicative, and d) to describe the maternal elicitations and responses to these behaviors.

The major findings were as follows: a) There were group differences in the total occurrence of three of the four potentially communicative infant behaviors. b) There was no group difference in the frequency of maternal attributions of communication. c) The groups required different

explanatory models that predicted the respective levels of frequency of maternal attributions. d) There was a positive within-handicapped sample relation between degree of handicap and maternal tendency to attribute. e) There was a positive within-handicapped group relation of maternal tendency to attribute with two variables indexing type of communicative infant behaviors. f) There were several within-handicapped group relations between degree of handicap and variables indexing type of communicative infant behaviors. g) There was a relation between presence or degree of handicap and the types of maternal elicitations of communicative behaviors. h) There was a positive within-handicapped sample relation between degree of handicap and maternal responsiveness to communicative behaviors.

It was noted that these results challenge the assumption that mothers of handicapped children respond less frequently to their infants than do other mothers. It was discussed that the discrepant results may be explained by the fact that the present study defined the "opportunity for a response" by the mother's judgment of when the child communicated; whereas, past research has used the coder's judgment of when the child communicated. The former option is seen as a desirable alternative because it utilizes the mother's interactive history to decide what possibly subtle or idiosyncratic behaviors are communicative. Indeed, the present results indicated that pre-linguistic communication in dyads with handicapped infants is, in part, a subjective phenomenon that requires special attention to the mother's general tendency to attribute communication when predicting the frequency and nature of maternal attributions of communication.

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Acknowledgements

This dissertation was not completed alone. Many of my friends, family, collegues, and professors helped in many ways at many stages of the project. So many people helped, in fact, that somebody will inevitably be left unacknowledged.

I give acknowledgement and thanks to the staff and investigators of CIREEH II who recruited the subjects and collected some of the data that were used in the present project. Among these people were Dr. Lynne Feagans, Dr. Dale Farran, Dr. Barbara Goldman, Dr. Jean Gowen, Dr. Nancy Johnson-Martin, Connie Kasari, and Lucy Harber.

I give acknowledgement and thanks to Tom Quinn and Ellen Peisner for the intelligent and diligent work they did as graduate assistants to the present project.

I give acknowledgement and thanks to several people who have provided statistical consultation to the project: Dr. Bill Ware, Dr. Mark Appelbaum, Peg Burchinal, Marje Martin.

I give acknowledgement and thanks to my committee: Dr. Lynne Feagans, Dr. Don Bailey, Dr. Rune Simmeonsson, Dr. Robert Cairns, and Dr. Cathy Dent. They provided the opportunity and motivation to do my best.

I give a special acknowledgement and thanks to Dr. Dale Farran who, having served as my chairperson for the first two years of my doctoral training, gave me many hours of her time, energy, and expertise in refining my writing and thinking skills as applied to mother-infant interaction research. Specifically, her ideas and critiques of my ideas lead to the conception of the dissertation.

I give acknowledgement and thanks to Dr. Lynne Feagans, my second chairperson, for sharing with me her data, ideas, and time in reading the countless drafts of the dissertation. The many details that she took care of as chairperson freed me up to attend to the real business of a doctoral program: learning.

I give acknowledgement and thanks to those people I worked with during my third year in the doctoral program. They gave me flexible working hours, support, books, video equipment, and a listening and intelligent ear. Among these people were Dr. Barbara Goldman, Dr. Don Bailey, and Dr. Joanne Roberts.

Special thanks and acknowledgment go to Dr. Karen O'Donnell who read and commented on the dissertation at the last minute.

I acknowledge and thank to Dr. David Yoder for his fine example as an academician and for his faith in me as a future one.

I acknowledge and thank my family who taught me that my best is just fine.

Mostly, I acknowledge and thank my wife, Jill, who gave me the love, freedom, and support to seek my goals and the perspective that they are not all there is.

CHAPTER I

Introduction

Early pre-linguistic communication can be thought of as behavior that mothers elicit, interpret, and respond to regardless of their babies' intentions. This tendency of Western mothers to interpret their babies' behavior as communicative has been called maternal attribution of communication. Professionals interested in exceptional child development have taken an interest in such attributions because they may influence the nature of mother-infant interactions and facilitate children's learning to communicate independently of their mothers' support.

The following section was written with several purposes in mind. First, a rationale for studying maternal attribution of communication is given. In so doing, a theoretical explanation of why maternal attributions may facilitate infant communication development and a brief review of the empirical basis for this theory are presented. Second, a multivariate model for explaining variance in the frequency of maternal attribution of communication is given. This model acknowledges the effect a handicap may have on maternal attributions. Third, a novel approach to measuring maternal attributions of communication is discussed. Fourth, the complexity of studying the effect of one partner of an interactive dyad on another is discussed. In this section, two ways one might deal with this difficult research problem are suggested. Fifth, the research questions for the present study are presented. And finally, the significance of the present study is discussed.

The Importance of Maternal Attributions of Communication

The Transition from Pre-linguistic to Linguistic Communication

It is well accepted that the development of language is crucial to children's educational, social, and cognitive development (Nelson, 1979). In an effort to explain how young children develop language, many researchers have attempted to show that infants develop communication skills very gradually (Golinkoff, 1983). That is, pre-intentional communication, such as reflexive crying, may gradually become intentional, pre-linguistic communication. This intentional pre-linguistic communication, in turn, may develop into linguistic communication. This model of gradual communication development helps explain the mystery of language development (Shatz, 1983; Snow & Gilbreath, 1983).

Some researchers have objected to the effort to demonstrate communicative continuity because, in their view, it implies a mechanistic view of development (Shatz, 1983). However, the interest in communicative continuity is not in conflict with an organismic view of development. Rather, one of the contributions of the concept of communicative continuity is that it may lead to a better understanding of the relative contributions of the infant and his environment. Shatz (1983) states that for us to explain the transition from one level of communication to another, we must identify both the precursor behavior and the mechanism by which the precursor behavior develops. In the past, researchers have typically fallen into two camps: those emphasizing social-interactive variables vs. those emphasizing cognitive variables. Although the two bodies of literature are often considered

dichotomous views of development (i.e. mechanistic vs. organismic), this dichotomy is not necessary. Snow & Gilbreath (1983) state, "Any hypothesis about the facilitative effect of a social-interactive variable implies a hypothesis about mechanisms that underlie cognitive development" (p.290). One such social-interactive behavior is maternal attribution of communicative intent.

Theoretical Importance of Attribution of Communicative Intent

Maternal attribution of communicative intent refers to occasions when mothers interpret their babies' behaviors as communicative, regardless of whether these babies actually intend to communicate. For example, mothers report their ability to discriminate and interpret several meanings in their four-month-old babies' crying (Ricks, 1977). However, few researchers actually believe that four-month-old babies intentionally change the nature of their crying to convey different messages to their mothers.

Some researchers have proposed that infants have two major motivations for communicating: to recruit and maintain social interaction, and to recruit nonsocial stimuli, e.g. objects or repetition of an interesting effect. A mother's interpretations of her baby's behavior may build on both of the proposed early sources of motivation to communicate.

The first motivation to communicate may be to satisfy a general desire to interact with the caregiver (Braunwald, 1983). This may be operationalized into performing an action which results in the provision of social attention. The "tension" created by a neonatal preference for visual and auditory stimuli which are characterized in the human face and mother's voice may stimulate the baby to produce undifferentiated

and unintentional movements, crying, etc (Fernald, 1984; Harding, 1979; Miller, 1984). The mother frequently imitates or reacts to her baby's unintentional movements, facial expressions or vocalizations thereby providing stimulation contingent on the baby's behavior (Kaye, 1982; Newson, 1979). Contingent interaction with mother may be particularly important because a Western mother tends to be one of the earliest and most available sources of contingent stimulation to her baby's behavior (Garvey, 1983). This contingent stimulation may facilitate the development of several cognitive and behavioral precursors of intentional communication.

For example, many researchers have suggested that contingent responding to the baby's actions help shape these actions first into more directed movements, then into more conventional gestures, and finally into more symbolic forms of communication (Golinkoff, 1983). It has also been suggested that contingent responding sets the stage for the infant to develop contingency awareness, i.e the infant's awareness that his actions may result in an effect (Watson, 1972; Golinkoff, 1984; Kaye, 1982; Newson, 1979). Many researchers have posited a relationship between contingency awareness or means-ends relations and later communication development (e.g. Harding and Golinkoff, 1979; Bates, et. al, 1979).

The second proposed source of motivation to communicate is the desire to achieve a more specific goal, e.g. obtain an attractive object. The achievement of goals implies the cognitive ability to associate a cause with an effect and produce actions directed to acquiring the goal. Since many goals are not within the infant's ability, the mother is an important agent for achieving these goals.

The mother's behavior may provide the context in which contingency awareness is developed, more goal-oriented behavior is facilitated, and awareness that mother may act as an agent is discovered. Harding (1984) describes the process which may take place:

> "Her (mother's) behaviors initially allow the infant's behaviors to become goal-directed (i.e. as the infant becomes cognitively aware of goals, the mother makes his early attempt at goal achievement successful). As the infant operates with more organization, she continues to participate in the achievement of goals. By inferring intent and reacting to his behavior consistently, she orders the infant's behavior in the world. However, the mother appears to anticipate her infant's cognitive abilities, (perhaps by reading early signs of transition) and begins to alter her supporting role by requiring more specific behaviors from her infant before she will act" p. 133.

If one is to evaluate the theory discussed above, the implict hypotheses must be made explict. There appears to be three sets of interrelated assumptions implict in the theory, namely a set of assumptions about the mothers' behavior, about the relation of the resulting interaction to infant development of behavioral and cognitive skills, and about the relation of these skills to later communication development.

The major assumptions concerning maternal behavior are:

1. Mothers interpret their babies' unintentional behaviors as communicative.
2. Maternal attribution of communication motivates mothers to respond systematically to their babies' behavior according to assumed intent.
3. The criteria that mothers use to determine that their babies are communicating changes as their babies develop.

The major assumptions concerning the relation of contingent interaction to the development of infant behavioral and cognitive skills are:

4. Responsive interaction facilitates the development of infant contingency awareness.
5. Responsive interaction facilitates the infant in recognition that people can act as agents on the babies' behalf to get what they want.
6. Consistent and differential responding to increasingly more conventional and symbolic communicative signals facilitates the development of more conventional, pre-linguistic communication.

The assumptions concerning the relation of certain behavioral and cognitive skills to later communication development are:

7. An infant must be aware of cause-effect contingencies for intentional communication to occur.
8. Recognizing that people can act as agents is necessary for intentional, instrumental communication.
9. Intentional pre-linguistic communication is a necessary precursor of later linguistic communication.

Empirical Support for the Importance of Attribution of Communication

Maternal attributions of communication are important apart from the validity of the above theory. They literally define what is communicative in pre-linguistic interactions. Regardless, it is important to evaluate whether maternal attributions have some facilitating effect on development. It is beyond the scope of this paper to evaluate exhaustively each of the assumptions in the above theory. However, a brief review of the empirical support follows. This review is organized around the above mentioned assumptions.

Assumption #1: Mothers interpret their babies' unintentional behaviors as communicative. The literature is replete with reports that

Western mothers do interpret their babies' pre-linguistic behavior as communicative, despite the fact that many researchers would not call these behaviors intentionally communicative (Als, 1982; Feagans, Garvey, & Golinkoff, 1984; Golinkoff, 1983; Shaffer, 1977). For example, Harding (1983) found that nine out of the 12 mothers she studied did interpret their babies' eye-contact and vocalizations as communicative; whereas, the researchers only considered one of these infants to be intentionally communicating.

Assumption #2: Attributions of communication motivate mothers to respond contingently to their babies' behavior. Only descriptive evidence is available to support the notion that such attributions of communication do relate to mother's contingent responding. In a laboratory setting, Harding (1984) found that the twelve mothers in her study responded to most of the types of infant behaviors that they recorded as communicative in a diary. We do not have data which addresses whether mothers are more likely to respond to behaviors that they call communicative than they are to those they call noncommunicative.

Assumption #3: The criteria that mothers use to determine that their babies are communicating changes as their babies develop. In the only published longitudinal study of maternal attribution, Harding (1984) found that the behaviors on which the mothers' attributed communicative intent changed as the infant matured. For example, several of the mothers interpreted their six-month-old infants' undifferentiated movements as communicative. But as their infants began to use instrumental behaviors for achieving goals, e.g. reaching for an

object, mothers appeared to adjust their expectations and responded differentially to more clearly object-directed behaviors.

Assumption #4: Responsive interaction facilitates the development of infant contingency awareness. Riksen-Walraven (1978) provides strong evidence supporting the facilitative effect of maternal responsiveness on contingency learning. She presented experimental data on 100 infants who were randomly assigned to four intervention groups. The groups were defined according to type of parent training that they received. The four groups were: Stimulating, responsive, stimulating and responsive, and no treatment control. "Stimulating" parental interaction is characterized by the parent introducing novel materials to the child and directing the child to play with these materials in novel ways. "Responsive" parental interaction involves playing with the materials which the infant initiates an interest. At the end of three months, Riksen-Walraven found that each group of parents showed different interactive styles which corresponded to the assigned treatment modes. That is, the mothers in the responsive group were more responsive than those in the stimulating group and vice versa. Children in the responsive group showed greater gains in exploratory behavior and contingency learning rates than the other children.

Assumption #5: Responsive interaction facilitates infants in recognizing that people can act as agents on their behalf. There is no clear evidence concerning this assumption. Golinkoff (1983) suggests that learning the concept of agency begins with learning to perceptually discriminate social versus nonsocial stimuli and to expect different effects from them. Although she presents a logical argument that the infant first learns to expect different effects from social stimuli

through conditioning , she provides no empirical support for this position. Perhaps one reason why this assumption has not been tested is that Piagetian theory underlies most of the research studying the cognitive prerequisites of communication. Piagetian theory pays little attention to the contributions of social factors to communication development (Rice & Kemper, 1984).

Assumption #6: Consistent and differential responding to increasingly more conventional and symbolic communicative signals facilitates pre-linguistic communicative development. As is often the case when researchers attempt to investigate a factor's broad effect, the evidence supporting the effect of responsiveness on the development of more conventional communicative behaviors is somewhat weak. There are many studies suggesting that children who have grown up in unresponsive environments are communicatively delayed (Braunwald, 1983; Tizard & Tizard, 1971, 1974). There is also evidence to support the notion that those infants who are raised in responsive environments are more communicatively advanced than those in less responsive environments. Mothers' consistent and contingent response to crying was found to be associated with infants' development of a differential repertoire of noncrying behaviors (Bell & Ainsworth, 1972). Harding (1984) found a positive correlation between dyads in which over 50% of the turns in the mother-infant interaction were infant initiated and those dyads which had communicatively advanced infants. However, much has been said about the inadequacy of correlations with respect to

inferring causality. And there have been no experimental studies on the effect of responsiveness to communication development.

Assumption #7 & #8: Infant contingency awareness and the concept of agency are necessary for intentional communication to occur. There are several studies which show correlations between means-ends relations or contingency learning and intentional pre-linguistic communication development (e.g. Bates, et al., 1979; Harding and Golinkoff, 1979). But experimental studies have not demonstrated that training means-ends relations increases pre-linguistic communication skills (Steckol & Leonard, 1981). There is no evidence that an infant understands that a person can act as an agent in his stead before he begins to communicate (Rice & Kemper, 1984). In general, both the concept of agency and contingency learning are logical components of communication, but we have no evidence that they are developed separately from and later applied to communication.

Assumption #9: Intentional pre-linguistic communication is a necessary precursor of later linguistic communication. There are several examples of children demonstrating pre-linguistic communication skills just before learning to speak (Bates, 1979; Sugarman, 1983) or exhibiting a concurrent delay in pre-linguistic and linguistic communication skills (Sugarman, 1983). But as Sugarman (1983) suggests, the question of whether pre-linguistic skills are prerequisites of linguistic skills is not purely an empirical one. Any relation between pre-linguistic skills and linguistic skills could be attributed to general cognitive or social development. If there is a relation between pre-linguistic and linguistic communication, it is probably at the general level.

Note that the above evidence is all collected from samples of Western mothers and infants. Schieffelin (1979) found that mothers from Kuali, New Guinea do not attribute communicative intent to their babies' early behaviors. Yet children in the New Guinea culture learn to communicate linguistically.

However, evidence that attribution of communication is not necessary for later communicative development has no direct implications upon the possibility that it may have a facilitative effect on later communicative development (Sugarman, 1983). There have been other instances in which nonessential behaviors have been found to have a facilitating effect. For example, Bower (1974) found exercising the walking reflex when the infant subjects were in the 1st month of life was related to early walking. Given the rarity of spontaneous exercise of the walking reflex, it is improbable that it is a prerequisite to walking. The possibly facilitating effect of maternal attributions of communicative intent is presently being investigated in an ongoing study (Feagans, unpublished data).

In summary, there is partial support for the notion that maternal attribution of communicative intent is a facilitating behavior for future communicative development. The exact mechanisms of how these attributions may affect communication development is not yet known.

The possibility that maternal attributions may facilitate development is particularly important for intervention with handicapped children. Additionally, as mentioned earlier, maternal attributions are also important because they define what is communicative within the mother-child interaction. Understanding what influences maternal

attribution of communication to behaviors of both handicapped and nonhandicapped children will contribute to our knowledge of how the presence of a handicap alters the quality of mother-child interaction. That is, an important step to understanding more about mother-handicapped child interaction is to explore why some mothers attribute more communicative intent to their babies' behavior than other mothers in a samples of handicapped and nonhandicapped infants.

Proposed Multivariate Explanation of Variance in Attributions of Communication

At present most researchers have studied variance in maternal attribution of communicative intent as if it is due to the influence of only one variable. By some researchers, it has been considered as a function of differences among mothers, i.e. differences in sensitivity to their babies' cues (Goldberg, 1977). Others have considered it a function of the frequency or nature of the infants' presenting behaviors (Lawrence, 1983). However, variance in maternal attributions has not been explicitly conceptualized and studied as having several sources of variance.

The proposed model assumes that sources of variance in maternal attributions of communication include differences in maternal characteristics, infant characteristics, and presenting infant behaviors. Although this model is not yet complete, the factors presented below are posited as an initial step at identifying factors which affect maternal attributions.

Variance Due to Maternal Characteristics

As mentioned earlier, the literature suggests that mothers in some other cultures do not tend to attribute communicative intent to

pre-linguistic behaviors (Schieffelin, 1979). In addition to cross-cultural data, data from a homogeneous group of American mothers suggest that even mothers of developmentally similar infants vary enormously on the number of attributions they make when viewing a 10 minute videotaped free-play session involving the mother and her child (Feagans and Robinson, 1985).

However, the contribution of what factors mothers bring to the interaction in terms of a general tendency to attribute has not been empirically investigated in the literature. The above data and pilot data suggest that this maternal factor is worthy of investigation. That is, given the same presenting behaviors, some mothers may attribute more communicative intent than others. And this general tendency to attribute may relate to the frequency with which mothers attribute communication to their own children's behavior. This general tendency to attribute may be due to some combination of personality characteristics and past experience with infants.

Variance Due to Presenting Infant Behaviors

Lawrence (1984) and Harding (1984) both found that the occurrence of maternal attributions of communicative intent were related to the occurrence of certain types of presenting infant behaviors. These two studies reported that mothers identified several behaviors that they called communicative, which for the purposes of the present study, can be categorized into four more general behavior categories: attending to mother, attending to an object, coordinating attention to object and to mother, and vocalizing.

Logically, attending to mother is a component of communication with mother. There is also evidence that eye-contact is a particularly

influential behavior on maternal attributions. Harding (1983) found that nine out of the 12 mothers studied did not attribute communicative intent until their babies made eye-contact with them. Eye contact is perhaps the one nonverbal behavior which is considered communicative for the longest period of time during an individual's life. Moreover, it is one of the earliest behaviors over which the infant has control and is therefore particularly suited as evidence of attention to mother in a study which includes developmentally young and handicapped infants.

Infant attention to an object provides mothers with a focus around which they can expand and elaborate their children's behavior (Schaffer, 1977). Since physically handicapped infants cannot exhibit the same reaches and actions that nonhandicapped children use when demonstrating attention to an object, gaze patterns can be used to determine when the infant is attending to an object. Pilot research of 12-month-old handicapped and nonhandicapped infants and clinical experience lead us to believe that object-directed gaze is an important class of behavior that parents of handicapped and nonhandicapped children use to interpret the intentions of their children. For example, the mothers in our pilot study seemed to use object-directed gazes to decide which toy to play with and how long to play with it (Yoder & Farran, in press).

Recent research suggests that normally developing children begin to combine attention to partner and to toys in close temporal succession at about nine - twelve months. Coordination of attention to mother and toy may serve to increase the probability that mothers will interpret the behavior as communicative (Lawrence, 1984; Harding, 1984). In fact, many researchers have proposed that behavior patterns which show the coordination of attention to mother and toy constitute evidence of

intentional communication (Bates, Camaioni, & Volterra, 1979; Harding, 1983; Sugarman, 1983). Examples of behavior patterns which demonstrate coordinated attention are looking alternately at mother and a toy, and handing a toy to mother. Note that these behaviors include mother in the infants' fascination with objects.

Vocalizations have great face validity for acting as precursors to linguistic communication. Perhaps their similarity in form to linguistic communication helps to partially explain why both mothers (Lawrence, 1984; Harding, 1984), and researchers (Greenfield and Smith, 1976; Halliday, 1975) often include vocalizations in their descriptions of early communication.

Variance Due to Presence and Degree of Handicap

The presence of relatively immature and occasionally idiosyncratic behavior and the diagnosis of the child as handicapped may influence the way maternal, behavioral, and infant factors interrelate to affect variance in maternal attribution of communicative intent. That is, the best predictive model for explaining variance in maternal attributions may differ in a sample of parents with nonhandicapped infants as compared to that for parents of handicapped infants.

There are two levels at which the presence of a handicap may affect maternal attribution of communicative intent. First, the handicapped infant may present the mother with quantitatively and/or qualitatively different behaviors thus influencing her interpretations of his behavior. Second, parents of handicapped children may interpret different infant behaviors as communicative than do parents of normal children.

There are several reasons why the behavior of a handicapped infant may be different from that of a nonhandicapped infant. The handicapped infant may be slower in developing the prerequisite skills, behavior, and cognitive readiness to benefit from a contingent environment (Sameroff and Cavanagh, 1979). This slower developmental readiness will result in delayed contingency learning and consequently delayed development of more mature and clear communicative behaviors, e.g. coordinated attention to mother and a toy. Especially relevant to the physically handicapped is the finding that muscle tone and activity level are related to contingency learning (Krafchuk, Sameroff, & Bakow, 1976). This is not to say that a physically handicapped infant will not learn cause-effect contingencies because of continued abnormal muscle tone. Rather, abnormal volitional movement and activity level make learning more difficult. In support of this notion, Als (1982) found that her multiply handicapped subject did not have stable states of alertness or attention to a stimulus, subsequently creating a situation in which the baby's cues were very difficult to interpret and thus to respond to with any degree of consistency.

Differences in the frequency of infant behavior also influence the frequency and degree of contingent maternal responding. Handicapped infants often emit fewer behaviors to which mother can respond. Jones (1977) found Down syndrome infants initiated less behavior than did a group of normal infants who were matched on developmental levels. She also found the mothers of the Down syndrome group were more directive than the mothers of the normal infants because the handicapped infants provided fewer behaviors to which mothers could respond than did normal babies.

When handicapped infants do emit some behavior, it may be difficult to interpret their meaning (Goldberg, 1977). If mothers cannot "read" the babies' cues, contingent responding is thwarted. Fraiberg (1977) found that some mothers of blind infants did not consider any of their infants' behavior as communicative until they were shown some consistent infant behaviors they could use as an indication of what the babies wanted. Ricks (1977) found that parents of autistic children had to learn their infants' idiosyncratic crying patterns before they could interpret them and respond contingently.

Parents of handicapped children may differ from other parents with respect to the nature of behavior on which they base their attributions and the frequency with which they make their attributions. First, in the absence of clear cues, these parents may interpret more subtle cues than parents of nonhandicapped children. In contrast, they may not interpret behaviors that other parents would interpret because some parents of handicapped children may not expect communicative behaviors from their children. This lower expectancy may result in less frequent and less contingent interaction. Kearsley (1979) suggested that this less than optimal interaction results in further retardation. These rather contrasting ways in which the presence of a handicap may affect what behaviors mothers call communicative are not mutually exclusive. They may operate at different times in a dyad's interactive history. For example, mothers may interpret very subtle cues as communicative while their infants are still very young, but expect increasingly less frequent communication as their children become older and their handicap becomes more apparent.

In summary, the presence of a handicap often results in infrequent, nondirected, and/or idiosyncratic behavior. The resulting infant behavior influences what the mother considers communicative in her child. This infrequent and unexpected behavior in conjunction with low expectations for intentional behavior may influence the mother to interpret her baby's behavior less frequently and thus provide a less-than-optimally responsive environment in which more conventional and mature communicative behaviors are usually learned.

Measuring Maternal Attributions of Communication

Measuring maternal attributions of communication is no simple task. It requires understanding what infant behaviors are meaningful and salient to the mother. A rather straightforward contingency analysis of the relation of mother's behavior to the infant's behavior is clearly inadequate in this regard. First, it is quite possible for a mother to interpret a baby's behavior as communicative, but not respond. Second, it is quite possible for a mother to respond without interpreting a behavior as intentionally communicative. Third, as Hayes (1984) points out, microanalytic coding of behavior ignores issues of salience and meaning. That is, it assumes a functional equivalence among behavioral units.

However, perceptual research (Newtson, 1976) indicates that people see the behavior of others as composed of several discrete units and that each "break point" between units is defined by changes in behavior that convey significantly more information and are significantly more salient than behaviors in "nonbreak" points. These "break points" can be reliably measured by a simple procedure in which subjects are asked to indicate when a significant event begins and ends. For the purposes

of studying maternal attributions, a mother's perception of salient and meaningful changes in her infant's behavior can be used to indicate which infant behaviors are more meaningful than others, thus addressing Hayes' caution against assuming functional equivalence of all infant behaviors. Therefore, the subjective nature of attributions requires that at least one component of the measurement system address what is meaningful and salient to the mother.

Alone, knowledge of when and how frequently mother interprets her baby's behavior as communicative does not tell us anything about what infant behaviors are meaningful. Additionally, such an approach ignores the role that mother plays in eliciting these salient infant behaviors within the interaction. Therefore, in addition to a subjective measure of maternal attribution, directly observing the actual infant behavior patterns and the interactive context in which these infant behaviors occur is an important component in measuring maternal attributions of communication. As Lieberman (1979) argued, the marriage of subjective methods and behavioral analyses will ultimately provide a better basis for understanding the organization of behavior than will either alone. Working back from subjective data to the behavioral analysis may provide rich insights into the nature of prelinguistic communicative behavior and its relation to mother's behavior within the interaction.

The Interdependency of Behaviors in Mother-Child Interaction

Our interest in explaining variance in maternal attributions of communicative intent requires that we address the phenomenon of "interdependency of behaviors within an interaction". The concept of interdependency refers to the mutual influence of interactive partners. In mother-child interaction this is seen in the finding that the

frequency and nature of one partner's behavior is dependent on the frequency and nature of the other partner. Thus, it is difficult to demonstrate a unique influence of one partner on another. In fact, Appelbaum & McCall (1983) refer to the problem of studying the effect of one member of a dyad on the other one of the most difficult problems of study in the field of developmental psychology.

The results of pilot research illustrate this notion of mutual influence of maternal responsiveness and infant behavior (Yoder & Farran, in press). We studied mother-infant interaction in two sets of fraternal twins. The male in each set of twins was handicapped while the female was not handicapped. This design allowed for a unique opportunity to explore the effect of a severe handicap on mother-infant interaction. In both sets of twins, the handicapped infant presented the mother with fewer object-directed behaviors which in turn resulted in fewer opportunities for the mother to respond to the child's "lead." The fewer maternal responses to the children's leads were related to the handicapped children spending less time in joint attention episodes. Both partners influenced each other. However, the degree of influence of one partner above and beyond the influence of the other partner was difficult to determine.

In an effort to identify which factor (mother vs. child) accounts for more variance in an outcome variable, some researchers have inappropriately used a multiple regression model in which their predictor variables come from the same session. For example, one might regress the duration of joint attention to a toy on a summary measure of maternal responsiveness and a summary measure of the frequency of object-directed actions. All three measures are collected from the same

free-play session. Such a design cannot allow us to say that variance in either of the predictor variables is due only to factors within the actor because the factors are interdependent on the behavioral context in which they occur. That is, the measure of the mother's behavior is not independent of the infant's behavior. Logical dependence of the predictor measures violates the assumptions of multiple regression thereby conclusions based on these data would be misleading (Appelbaum & McCall, 1983).

To take the interdependency of behaviors into account, one could measure the independent contribution of a child factor and a mother factor by collecting these measures in separate contexts and use a standardized assessment format. These factors could then be measured in such a way that the presence of one factor would have no immediate effect on the other, thus meeting the assumption of independence necessary for parametric analysis.

Obviously, an additional criteria for measures of child and maternal factors which may affect maternal attribution of communication is that they are theoretically related to maternal attribution. For example, a measure of the degree of voluntary movement and presence of primitive reflexes in a sample of handicapped children may index the clarity of pre-linguistic communicative signals that an infant is likely to give to his parent. Similarly, maternal ratings of the communicative strength of several standard videotaped scenes of a mother and infant interacting may provide an index of the mothers' relative tendency to attribute communication to pre-linguistic behaviors. Both of these examples can be administered in a separate context, using a standard format, and are conceptually related to maternal attributions of

communication to their own children's behavior. The analysis of summary scores from such measures would allow us to evaluate the relative importance of the factors that the partners bring to the interaction.

Equally important is the question of how the mother and the infant affect each other within the interaction. Specifically related to the phenomenon of maternal attributions, how does the mother support and stimulate those infant behaviors she calls communicative? A sequential coding scheme of the actual maternal behaviors which precede and follow communicative infant behavior may provide valuable descriptive information on the mother's supporting role.

Again, our pilot study provides an example of how descriptive analysis can suggest ways in which mothers' and infants' behavior are interdependent within an interaction. The mothers in our study showed different interaction styles. The infants showed corresponding differences in their behavior. These differences may suggest how the mothers' behavior influences the infants' behavior. We found that both the handicapped and normally developing child of the mother who engaged in fewer repetitive, contingently responsive sequences (Bruner, 1983) showed developmentally younger communicative behavior than those children of the mother who engage in several bouts of repetitive sequences (Yoder & Farran, in press).

In summary, it is possible to design a series of studies to test the significance of the aforementioned factors while meeting the statistical assumption of independence in parametric analyses and address the mutual influence of behaviors in social interaction. The first such study could involve using measures of the predictor factors which are assessed in a separate contexts. Below is a graphic depiction

of a study which is designed to investigate the relative contributions of three factors in predicting variance in the frequency of maternal attributions. The static representation below does not necessarily suggest a unidirectional or causal relation of these factors to the frequency of maternal attributions. For example, it is possible that the associations between predictors and the criterion variable are bidirectional and/or indirect. The following figure is offered only for the purpose of summarizing and integrating the section of this paper on a multivariate explanation of variance in maternal attributions with the present section.

Figure 1

Suggested Design to Study Variance in Maternal Attributions of Communication While Meeting the Assumption of Independence

Predictors	Criterion Variable
What mother brings to the interaction (e.g. mother's tendency to attribute)	Frequency of maternal attributions of communication to own infant's behavior.
What infant brings to the interaction (e.g. degree of infant handicap)	
Actual infant behaviors in interaction (e.g. attention to mother or vocalization)	

Additionally, a descriptive analysis of how mothers elicit and support the actual communicative behavior addresses the reality of the interdependence of behaviors in social interaction. That is, a descriptive analysis puts the infant behavior back in its natural context and investigates how mothers and infants influence their partner's behavior. The following figure illustrates one way to investigate mutual influence in a dyad. Sequence of presentation reflects sequence of occurrence.

Figure 2

Suggested Design for Analyzing the Behavioral Context of Infant Behaviors that Mother Identifies as Communicative

Presence or absence of maternal of behavior.	Infant communicative behavior (according to mother's judgment)	Presence or absence of maternal response to behavior.

The combination of the analysis of summary scores of independent measures and the descriptive analysis of the behavioral context of the behavior of interest allows us to address questions about a) the relative importance of one factor over another in a sample and b) the interactional context of the phenomenon of interest.

Research Questions and Rationale

This section details the research questions (RQ) for the present study. Each question is then followed by a rationale (R). The questions and rationale are organized according to two component studies. The first deals with a multivariate investigation of sources of variance in the frequency of maternal attributions. The nature of the research questions in the first study are a priori hypotheses. The second deals with the nature of the communicative infant behaviors and their behavioral context. In contrast with the first study, the second study is more exploratory than confirmatory, therefore its research questions are not accompanied by hypotheses.

Unlike many studies with comparison groups, the present study primarily investigated relations between variables. Questions concerning the relation of degree of a handicap on various dependent measures were addressed through within-handicapped sample analyses. A within sample analysis allows a more powerful test of the effect of a handicap on a dependent measure because it utilizes the full range of scores that index degree of handicap; whereas, a group comparison (handicapped vs. nonhanidicapped) would treat all types and degree of handicap as equivalent. Therefore, group comparisons will be used to determine how the groups differ, primarily for descriptive purposes; and within handicapped group analyses will be used to determine the relation of degree of handicap to the dependent variable.

The following research questions and subsequent report involve two variables that may be confusing: a) specific frequency of maternal attributions of communication and b) general maternal tendency to

attribute communication. The specific frequency of maternal attributions of communication (SFMAC) refers to the number of attributions of communication that a mother makes to her own child's behavior while viewing a videotape of interaction with her own child. This variable was used as the dependent measure for most of the research questions in the first study. In contrast, general maternal tendency to attribute communication (GMTAC) refers to the mother's tendency to attribute communication to pre-linguistic behaviors in a general sense. For example, when viewing the same infant behaviors of an unfamiliar baby, those mothers who attribute communication relatively more frequently and with relatively more certainty about their judgment are considered to have relatively high general tendencies to attribute communication. GMTAC is used as a predictor variable in both the first and the second study. Henceforth, these two variables will be referred to by their acronyms.

Study #1:

RQ1. Are there group differences with respect to the specific frequency with which mothers attribute communication to their own children's behavior (SFMAC)? It was predicted that the mothers of nonhandicapped infants would attribute communication to their children's behavior more frequenctly than would mothers of handicapped infants.

R1. The literature suggests that the presence of a handicap may effect both the presenting infant behaviors and the general maternal tendency to attribute communication (GMTAC), both of which may affect the frequency with which mothers attribute

communication. For example, handicapped infants may give less frequent and less clear communicative signals. Additionally, mothers of handicapped children may be less likely to interpret communicative signals because she does not expect communication from her handicapped infant.

RQ2a. Are general maternal tendency to attribute communication (GMTAC) and the relative occurrence of presenting infant behaviors related to the specific frequency of maternal attribution of communication to their own babies' behavior (SFMAC) in samples of dyads with handicapped and nonhandicapped infants? A positive relation between both predictors and the frequency of maternal attributions (SFMAC) was expected in both groups.

RQ2b. Is the significance of these relationships different in a sample of handicapped infants when compared to a sample of nonhandicapped infants? It was predicted that GMTAC will be of more strongly related to SFMAC in the handicapped sample than in the nonhandicapped sample.

R2. Pilot work and previous literature have suggested that both factors influence the frequency and nature of maternal attributions of communication when studied alone. Past work suggests that these relations are in a positive direction. GMTAC may be of greater relative importance in the handicapped sample because these mothers may need to infer communication from less clear communicative signals. Alternatively, these mothers may expect less communication from their infants resulting in less of a general maternal

tendency to attribute communication (GMTAC) which in turn may influence how frequently they attribute communication to their children's behavior when in an interaction (SFMAC).

RQ3. Is degree of their infants' handicap related to the mothers' general tendency to attribute communication (GMTAC)?

R3. Pilot work and logic suggest that interactive experience influences what behaviors mothers call communicative. One important source of influence, then, may be interaction with a handicapped child. More specifically, a mother of a severely handicapped infant may be used to interpreting very subtle communicative cues and this may influence her to call most directed behaviors communicative. Alternatively, a mother of a severely handicapped infant may expect less communication from infants because of her experience with a handicapped infant who seems uncommunicative. Therefore, direction of the relation is not predicted here.

Study #2

RQ4. Is general maternal tendency to attribute communication (GMTAC) related to the types of behaviors that mothers call communicative when viewing interaction with their own children?

R4. It is reasonable to infer that mothers who tend to attribute freely will interpret relatively weak signals as communicative. By the same logic, it is reasonable to infer that mothers who tend to attribute less freely will only interpret relatively strong signals as communicative.

RQ5. Is degree of infant handicap related to the type of behaviors that mothers call communicative when viewing interaction with their own children?

R5. The literature suggests that some handicapped infants give qualitatively different behaviors to their mothers to interpret as communicative. In an effort to interact responsively to their infants, mothers of severely handicapped infants may interpret different behaviors than those interpreted by mothers of mildly handicapped children.

RQ6a. To what extent do mothers elicit the behaviors they call communicative?

RQ6b. Is degree of handicap related to the proportion of communicative behavior clusters that mothers elicit?

RQ6c. Is the degree of handicap relate to the nature of these elicitations?

R6. Much has been written concerning mothers' roles in facilitating developmentally normal infants' execution of effective behaviors (Bruner, 1983; Vygotsky, 1978). However, developmentally older infants initiate a new focus of attention more frequently than do developmentally younger infants (Adamson and Bakeman, in press). Therefore, mothers of mildly handicapped and normal infants may not need to elicit communicative behaviors as frequently as do mothers of severely handicapped infants. Additionally, mothers of developmentally older infants respond to more distal and less directive elicitations than do developmentally younger

infants (Lewis and Ban, 1971). Likewise, mothers of developmentally older infants use more distal elicitations (Beckwith, 1971; Lusk and Lewis, 1972). Therefore, mothers of severely handicapped infants may use elicitations that are more proximal and directive in nature than those used by mothers of normal or mildly handicapped children.

RQ7a. To what extent do mothers respond to behaviors that they call communicative?

RQ7b. Is degree of infant handicap relate to the proportion of communicative behavior clusters to which mothers respond?

R7. The theoretical literature concerning the possible effect attributions have on later development predicts that these attributions motivate mothers to respond contingently to the behavior to which the attribution was made. However, there is no theoretical reason why this relationship should differ because of the presence or degree of a handicap. But some authors have suggested that mothers of handicapped infants are more directive and possibly less responsive than other mothers (Bromwich, 1981). This difference could be due to the difference in infant behaviors that mothers are given to interpret, not to differences within the mothers. This study sheds light on possible causes to the allegedly more directive style of mothers of handicapped infants. It should be noted that this study addresses responsiveness to behaviors mothers call communicative; it does not address mothers' responsiveness to behaviors they do not identify as

communicative. A specific mother may not interpret some behaviors that some researchers do call communicative (Fraiberg, 1977).

Significance

The focus of the present project is on the parents' perception of their infants' behavior. Apart from any relation attribution of communication may have with later development, parents' perception of their babies' behavior is seen as important in its own right. It is the parents' interpretation and responsiveness to their infants' behavior that define or fail to define a behavior as communicative. Therefore their perception of their infants' behavior is very important in determining the quality of mother-infant interaction.

Attribution of communication has been proposed as a mechanism for change in the transitions from unintentional to intentional communication and from pre-linguistic to linguistic communication in Western cultures. Understanding more about this possibly facilitating behavior is important in providing insight into how children in this culture may learn to communicate.

This study measures maternal attribution using a combination of a subjective and an objective measure. As has been suggested in the literature, this marriage of subjective and objective measures allows us to identify which behaviors are particularly salient and meaningful to an individual mother and describe these behaviors objectively. To this investigator's knowledge, this combination of methods to study maternal attribution is novel.

Researchers have only recently begun to study maternal attribution of communication. Perhaps this is why no study to date has attempted to test the validity of a measure of maternal attribution. The combined use of an objective measure will allow the investigator to test the construct validity of the more unfamiliar subjective measure of maternal attribution of communication by asking if mothers respond to behaviors they call communicative.

The first study acknowledges the multivariate nature of maternal attributions. The procedures were designed specifically to investigate the combined and individual contribution of three important factors in explaining why some mothers attribute more communication than other mothers. The study was designed to allow the investigation of the influence of factors that mothers and infants bring to the interaction by assessing these factors in a standardized fashion and in a context separate from that used to collect the dependent measure. The measure for the maternal factor provides an index of what mothers bring to the interaction in terms of their relative general tendency to attribute communication. The inclusion of this independent maternal factor is a unique method of studying one aspect of maternal influence on the frequency of maternal attributions while meeting the statistical assumption of independence. To this investigator's knowledge, this study is also unique in its multivariate investigation of variance in the frequency of maternal attribution of communication.

However, analyses involving summary scores indexing the frequency of maternal attributions can mask several interesting aspects of the phenomenon of interest. The second study investigates the occurrence

and nature of the maternal attributions at the level of the interaction. The relations of the type of behaviors mothers called communicative to factors that the mother (i.e., GMTAC) and the infant (i.e., degree of handicap) bring to the interaction are tested. Additionally, an analysis of the relation of these communicative infant behaviors to maternal behaviors that elicit and respond to these infant behaviors provides a way to describe and demonstrate the bidirectional nature of mother-infant interaction as it relates to maternal attribution of communication. In summary, this study approaches the study of maternal attributions in a manner that allows two levels of analysis (macro- and micro-analytic) and two aspects of the phenomenon of interest (frequency and nature of maternal attributions).

For intervention with parents of handicapped children to be of maximum benefit, we need to study how possibly facilitating behaviors such as attribution of communication may vary along dimensions that are unique to parents of handicapped children. The unique influences associated with the presence of a handicap on maternal attributions were studied using within-group and between-group analyses. That is, a sample of mother-handicapped infant dyads was included in this study allowing this researcher to investigate within sample factors that affect attribution of communication that may vary with the degree of handicap experienced by the infant. Additionally, the present study allows for comparison of how maternal attribution of communication may vary in mothers of handicapped children as compared to that of mothers of nonhandicapped children. Once again, this author believes this study is unique in utilizing a sample of parents of handicapped infants to

investigate what factors affect mothers' perceptions of their handicapped infants' behavior.

In summary, understanding what dimensions influence mothers to interpret their babies' behavior as communicative is crucial to understanding pre-linguistic communication. After all it is the mother who defines what is communicative. Additionally, attribution of communication may facilitate infant communicative development. This possibly facilitating behavior has implications for intervention with handicapped children. The presence of a handicapping condition may alter mother-infant interaction. Therefore effective intervention with parents of handicapped infants must be based on an understanding of not only the factors affecting parents of normal infants, but also those unique factors that affect parents' perception of their handicapped infants. In short, the present study provides an opportunity to better understand the nature of pre-linguistic communication in both normal and handicapped populations.

CHAPTER II

Method

Collaboration with an Ongoing Study

The sample used for the present study includes a subset of the handicapped and nonhandicapped infants already recruited by the Parent Child Reciprocity (PCR) project of CIREEH. PCR is a federally funded longitudinal project designed to study several aspects of mother-child interaction.

Members of the PCR project recruited subjects and conducted free-play sessions, coded infant gaze patterns, tested infant cognition and motor development, and collected the frequency of maternal attributions to their own babies' behavior.

The present study was responsible for recruiting subjects from the existing sample to participate in an additional procedure that this investigator designed and administered. This additional procedure was the independent measure of general maternal tendency to attribute communication to a standard set of behaviors (GMTAC). The present project also designed and collected the measures of infant vocalization, coordinated attention to mother and toy, and the nature and behavioral context of communicative behaviors.

Subjects

The subjects for this study were 16 mother-handicapped infant dyads and 16 mother-nonhandicapped infant dyads that were recruited through the PCR project and agreed to participate in an additional procedure for the present study. Since both infants and mothers were the subjects for the study, their characteristics are discussed separately.

Infant Characteristics

Recruitment and selection criteria. The 16 developmentally delayed infants were recruited through referrals from pediatricians, pediatric clinics, physical therapists in private practice, three local hospitals (North Carolina Memorial, Duke University Medical Center, and Durham County General), genetics clinics, and the Parent and Child Together (PACT) infant intervention teams serving surrounding areas. The characteristics of those infants included in the handicapped sample met state guidelines for infants classified as in need of developmental intervention, i.e. significant delay in one or more areas of development. Additionally, all of the infants in the sample had intact visual and hearing abilities. The 16 normally developing infants were recruited through parents' voluntary responses to information packets at local pediatric clinics.

For the purposes of this project, the children were seen at approximately 11 months. This age was selected for two reasons: a) by 11 months most of the handicapped infants in our sample were actively interacting with toys and mother, but not yet speaking and b) this developmental period allows observation of maternal attribution of communication to behaviors of interest such as coordinated attention to mother and to toy (Bates, et al., 1979). That is, viewing the children at 11 months allowed the investigation of mothers' attributions of communication to infant pre-linguistic behaviors.

Primary diagnoses of handicapped infants. The handicapped sample was a heterogeneous group with a wide range of abilities and etiology of handicap. The heterogeneous composition of the handicapped sample was

necessary due to the low incidence of an identifiable handicap at only 11 months of age. Table 1 depicts the breakdown of the handicapped sample into these five diagnostic categories.

Place Table 1 about here

Sample characteristics on infant variables. The PCR project attempted to match the samples of children with respect to race and chronological age of infant. Table 2 summarizes these variables by sample showing that an approximate sample match on these variables was achieved.

Place Table 2 about here

As shown in Table 2, the infants were approximately 11 months old and predominantly caucasian.

The nature of the intact groups dictates that any comparison of handicapped and nonhandicapped samples is an imperfect one (Ryan, 1977). Significant handicapped vs. nonhandicapped group differences can best be understood when samples are described on unmatched variables as well. Therefore, Table 2 also details how the groups compared on demographic and psychological variables that were not controlled. Although, not specifically matched, the samples are also comparable on two potentially important demographic variables: sex and parity.

This table indicates that the handicapped sample had an average mental developmental quotient of 65.50 with great variability. The normal sample's mean is in the high normal range reflecting the highly

Table 1

Diagnoses of Handicapped Group

Diagnosis	Number	Percent of Group
Physically Handicapped	3	18.75%
Developmentally At Risk	1	6.25%
Mild Overall Delay	3	18.75%
Severe Physical and Mental Handicap	5	31.25%
Down Syndrome	4	25.00%
TOTAL	16	100.00%

Table 2

Sample Description on Infant Variables

Demographic Variables	Group: Handicapped (n = 16)	Group: Nonhandicapped (n = 16)
Race of Child		
White	15 (93.75%)	14 (87.50%)
Black	1 (6.25%)	1 (6.25%)
Other	0 0	1 (6.25%)
Chronological Age in Months	$\bar{x}$ = 11.60 sd = .78 r = 10-12.4	$\bar{x}$ = 10.41 sd = .52 r = 9.3 - 11.33
Sex of Child		
Female	6 (37.50%)	8 (50.00%)
Male	10 (62.50%)	8 (50.00%)
Birth Order of Infant		
1st	8 (50.00%)	9 (56.25%)
2nd	6 (37.50%)	5 (31.25%)
3rd	0 0	1 (06.25%)
4th	2 (12.50%)	1 (06.25%)
Child's IQ		
(Bayley MDI)	M = 65.5 SD = 28.93	M = 118.19 SD = 10.09
Child's Motor Development		
(MAI Risk Score)	M = 32.6 SD = 15.87	M = 8.19 SD = 5.06

educated population of Chapel Hill. The motor development score is a risk score, i.e. the higher the score the more severe the motor delay or difference. A score of 32.6 indicates moderately severe motor delay while a score of 8 indicates essentially no motor delay. (See the section labelled "Detail of Procedure and Assessment of Variables in the First Study" for further information on the instrument measuring motor development, i.e., Movement Assessment in Infants).

Maternal Characteristics

Sample characteristics on maternal and family variables. As with the important infant variables, the samples were matched on two important family variables: maternal age and number of children at home. Table 3 indicates an acceptable sample match on these variables. In general, the mothers were about 30 years old and have one or two children living at home. The infants are all living with their two biological parents. Table 3 also indicates some group difference in the family income and maternal education of the sample. However, these data indicate that both samples were highly educated, e.g. all mothers had at least some post high school training and most have completed college. All but four of the families in the total sample earned more than $15,000 a year. That is, there was little within sample variance on both maternal education and family income variables. Therefore the results of this study should be generalizable only to middle class families.

Place Table 3 about here

Table 3

Sample Characteristics on Maternal and Family Variables

Maternal or Family Variables	Group: Handicapped (n = 16)	Group: Nonhandicapped (n = 16)
Matched Variables		
Maternal Age in Years		
	M = 31.57	M = 29.98
	SD = 5.01	SD = 3.91
Number of Children at Home		
1	8	9
	(50.00%)	(56.25%)
2	6	5
	(37.50%)	(31.25%)
3	0	1
	0	(06.25%)
4	2	1
	(12.50%)	(06.25%)
Unmatched Variables		
Maternal Education		
Some College	2	3
	(12.5%)	(18.75%)
Special Post-High	3	0
School Training	(18.75%)	0
College	5	8
	(31.25%)	(50.00%)
Graduate or	6	5
Prof. Training	(37.50%)	(31.25%)
Family Income		
Under 15,000	1	3
	(6.25%)	(18.75%)
15,001 - 25,000	8	4
	(50.00%)	(25.00%)
25,001 - 40,000	3	5
	(18.75%)	(31.25%)
Over 40,001	4	4
	(25.00%)	(25.00%)

Reliability Procedure

This section describes the procedure and rationale for how the inter-observer and test-retest reliability estimates for measures in both component studies were obtained.

Inter-observer reliability estimates were obtained for all measures collected in this study except the measure of maternal tendency to attribute communication (GMTAC). Test-retest reliability was estimated for this measure because only the stability of mother's rating was relevant to the study. As recommended by Mitchell (1979), each reliability coefficient was estimated at the level of analysis used in substantive analyses of the studies. That is, if summary scores are used in the statistical analyses, then reliability of these summary scores is the relevant level of analysis.

Generalizability theory (Cronbach, Rajaratnam, & Gleser, 1963) was used as a basis for estimating inter-observer and test-retest reliability for the measures in this study. G coefficients or intra-class correlations are based on the analysis of sources of variance (ANOVA) of a sample of scores. Such an approach allows for the partitioning of variance in scores to several different sources. Different observers or test times are relevant examples of sources of variance. The variance estimates computed from a simple subject by observer or occasion ANOVA are then used to calculate a G coefficient representing the reliability estimate (Berk, 1979). The formula for calculating this coefficient from the relevant variance estimates is as follows:

$$p^2 = \frac{k(\text{between subject variance estimate})}{k(\text{between subject var. est.}) + \text{between observer}^{*}\text{ var. est.} + \text{error var.}}$$

Where k= the number of observers or occasions.
* For test-retest reliability, between-occasions variance estimate is used instead of between-observer variance estimate.

This coefficient is an intra-class correlation coefficient representing the ratio of the variance of the estimated "true" score to total variance of scores. G-coefficients are interpreted much like other more common reliability coefficients. That is, the closer the coefficient is to 1.00, the more reliable the scores. However, there is disagreement concerning how high a G-coefficient must be to consider scores acceptably reliable. Recommendations range in the literature from above .80 (Berk, 1979) to above .60 (Mitchell, 1979).

The relevant advantages of generalizability theory over other alternatives for estimating inter-observer and test-retest reliability are as follows (Berk, 1979): (a) G-theory yields an estimate of reliability while controlling for chance agreement due to limited variability of scores or underestimated agreement due to extreme variability of scores. (b) G-theory yields an estimate of reliability on a variety of continuous and categorical data making it particularly well suited for observational data. (c) Calculation of the G-coefficient can be easily modified to different numbers of subjects, observation periods, and observers.

Study 1

Purpose and Design of First Study

The first study used structured format assessment procedures and behavioral coding of free-play sessions to investigate the relation of variance in summary scores indexing levels of independent maternal and child factors to variance in summary scores indexing frequency of

maternal attribution of communication (SFMAC). A regression model was used to test a multivariate model for predicting variance in maternal attribution of communication in samples of handicapped and nonhandicapped infants. The identification of significant predictors and their interrelation is a first step in better understanding what influences maternal attribution of communication.

Overview of Procedure

Although the subjects engaged in procedures for other parts of the PCR project, the mother-infant dyads participated in four procedures that were relevant to this study: (a) The infant was administered a structured-format infant movement assessment. (b) The mother and infant were recorded while engaging in a 20-minute free-play session. (c) The mother viewed 10 minutes of the videotape and indicated when she interpreted the baby's behavior as communicative. And (d) the mother viewed 20 standard scenes of an unfamiliar 12-month-old and trained adult playing and rated how strongly she felt the child's behavior was communicative. Following is a detailed description of each procedure, the measures derived from these procedures that were used in first study, and the reliability of each measure.

Detail of Procedures and Assessment of Variables in the First Study

Structured-format infant movement assessment. Infant neuromotor development was assessed using the Movement Assessment of Infants (MAI) (Chandler, Andrews, & Swanson, 1980). When the infant was approximately 11 months old, he and his mother came to Frank Porter Graham Child Development Center. The infant was assessed on a mat in the PCR laboratory. Using several developmentally appropriate toys, the examiner followed the semi-structured format specified in the test manual. The

examiner was a member of the PCR staff who was specifically trained in administering the instrument.

The MAI consists of four subscales: muscle tone, automatic reactions, primitive reflexes and volitional movement. Target behaviors were elicited using specified procedures and rated along the continuum of a 4 or 6 point behaviorally anchored rating scale. A composite score that reflects the degree of delayed or disordered movement patterns was derived for each subscale. A total risk score was derived from the sum of these subscale scores. That is, the higher the score, the greater the indication of a motor handicap.

The total risk score was used to index the degree of handicap in the handicapped group. The MAI was used instead of an index of infant cognition such as the Bayley MDI to measure degree of handicap for several reasons. First, the Bayley is notoriously invalid for predicting later cognitive status in infants (McCall, 1979). Second, the Bayley and other infant cognition tests require much motor development to demonstrate mastery of an item, therefore there is much intercorrelation of Bayley and MAI scores (Johnson, Jens, Gallagher, & Anderson, 1980). Third, the Bayley does not provide a mental developmental index, a score analogous to an IQ, for children scoring under 50. Many of the infants in our handicapped sample scored under this floor. One can use extrapolation procedures to estimate a score, but this provides discontinuity and reduced variance in the distribution of scores making statistical analysis misleading. Fourth, several neuromotor skills directly affect the clarity of communicative signals. For example, the MAI assesses muscle tone which has been implicated in altering activity level and facial expressions. Fifth, the MAI is

sensitive enough to detect subtle differences in neuromotor development in handicapped and nonhandicapped children (Kasari, 1985). Sixth, the MAI has been shown to have acceptable test re-test reliability (.72) and significant predictive validity to later cognitive and motor scores for 4-month-old handicapped infants (Harris & Swanson, 1984 as cited in Kasari, 1985). In short, the MAI is a reliable, sensitive measure of abilities that potentially affect the clarity of the infant communicative signals .

Kasari (1985) carried out the reliability study on the MAI scores used in this study. Based on ten subjects, 31% of this study's sample, inter-rater reliability of the total risk score using two raters was extremely high, .98.

Twenty minute free-play session. The free-play session was usually recorded during the same session as that used to collect the MAI. However, in a few cases the infant's short attention span necessitated returning within a week for a second session to complete the procedures. The setting for the videotaped free-play session was a carpeted area of a lab. In the area were large pillows, a mat, several developmentally appropriate toys, a small table and chair, a changing table, and a few magazines. Figure 3 illustrates the setting for the free-play sessions.

Place Figure 3 about here

The parents were told the following instructions before the free-play session began, "We are interested in how babies play with

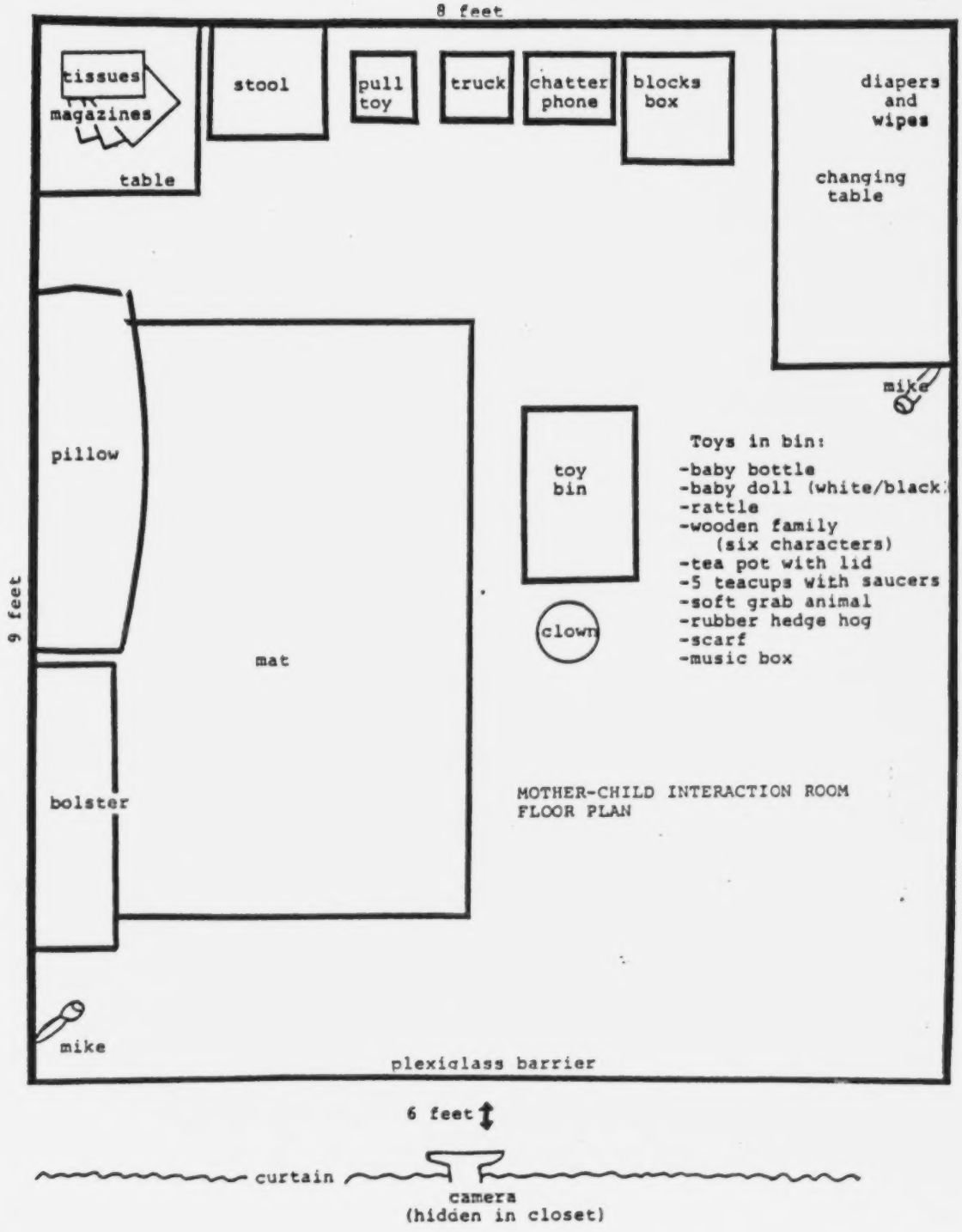


Figure 3. Diagram of Laboratory Arrangement for Mother-Infant Interaction Session

toys and their mothers. So just play with your child as would if you were at home." The free-play sessions were videotaped for later analysis.

Four measures of infant behaviors were based on the free-play sessions. Two of these measures were taken live by members of the PCR staff: frequency of gazes to mother and frequency of gazes to a toy. Live coding of these two behaviors allowed observers a dynamic viewing angle. Two other measures were coded from videotapes of the free-play sessions: duration of vocalizations and frequency of behaviors showing coordinated attention to the mother and to the toy. Behaviors that exemplify coordinated attention to mother and toy include (a) handing an object to mother, (b) alternating gaze to mother and a toy or vice versa, and (c) reaching or pointing toward an object while simultaneously or alternately looking at the mother.

The gaze and vocalization data were recorded using an electronic data collection device capable of recording frequency, duration, and time of occurrence data. The device is called an OS3 by Observational Systems, Inc. The coordinated attention data were recorded via a paper and pencil method using slow motion and repeated viewings of the picture. A summary score derived from these procedures was used in the statistical analysis of the data.

As mentioned in the review section, these four infant behavior types have been identified in the literature as particularly salient pre-linguistic communicative signals. It has been noted that direct observation of behaviors is a particularly useful method of measurement for studying how actual behaviors are related (Cairns and Green, 1979). Since one of the research questions is how the frequency of attributions

of communication is related to actual behavior, direct observation serves the investigator's purpose well.

Generalizability analysis of inter-observer reliability on these data indicated extremely high reliability. On eleven randomly selected subjects, 34% of the total sample, inter-observer reliability was estimated at .99 for total frequency of gazes to toy and .96 for total frequencies of gazes to mother. On seven randomly selected subjects, 22% of the total sample, inter-observer reliability was estimated at .99 for total duration of vocalizations and .98 for coordinated attention to mother and toy.

Maternal viewing of free-play session. Immediately after the free-play session, the research assistant asked the mother to come into the videotape viewing station in the lab. She was given the OS3 with a template covering all but two buttons for her to push. One button was marked "yes" and the other was marked "no". The research assistant gave the mother the following instructions: "Since you know your baby better than we, we are particularly interested in when you think your baby is communicating. So I'd like you to watch the first 10 minutes of the session that you just completed and push the button marked "yes" when the baby begins communicating and push the button marked "no" when he stops communicating." It should be noted that mothers were not given specific instructions concerning what unit of analysis to use when breaking the free-play session into communicative and noncommunicative segments. This was done to allow mothers to segment the behavior into what Newtson (1976) called "natural units of analysis". That is, it was assumed that if left to their own devices, mothers would segment behaviors into units most meaningful to them. Additionally, mothers were

not instructed concerning the meaning "communication". This was left to the mothers' interpretation because the focus of the project was on individual differences in subjective concepts of communication. Mothers were given a practice run on about the first two minutes of the tape to become familiar with the procedure. Pilot testing of this procedure showed that mothers have difficulty telling when communication ends, but this aspect of the procedure was maintained to prompt the mothers to take their finger off the "yes" button once they had pushed it. Pilot data on this measure indicates test-retest percent agreement of the frequency of instances of communication to range from .67 to .93 with a mean of .81.

Frequency counts of the number of times the mother pushes the "yes" button was used as the measure of the specific frequency of maternal attribution of communication to her own child's behavior (SFMAC). This measure was an efficient way to record the mother's subjective interpretations of her baby's behavior. The subjective aspect of the measure is particularly important because maternal attributions of communication are intrinsically subjective phenomenon.

This measure of maternal attribution is somewhat novel. As discussed in the review section, mother's indication of when communication occurs offers valuable information about particularly salient and meaningful infant behaviors that the sole use of direct observation of interaction cannot address. Research that tests the validity of this type of procedure and has shown that behaviors at "break points", maternal attribution in this case, contain more information than behaviors at "nonbreak points" (Newtson, 1976).

Time of occurrence data will be used in the second study to identify exactly what behaviors the mother interpreted as communicative and the behavioral context in which these behaviors occur. More detail concerning the procedure for testing construct validity of this subjective measure will be presented in the section labelled "Variables Derived from Discontinuous Probe Analysis".

Maternal viewing of the standard videotaped play scenes. At a later period, which varied among mothers, all mothers in the sample viewed in their homes or at the center a videotape of scenes of an unfamiliar adult-infant dyad interacting. The mothers then rated the infant behavior depicted in the scenes according to their communicative value.

The purpose of constructing this procedure was to design a set of stimuli that would elicit variance in the degree to which mothers rated the depicted behaviors as communicative. Past studies have shown that certain behaviors are highly likely to be interpreted as communicative (i.e., strong signals) while others are less likely to be so (i.e., weak signals). Past studies suggest that the coordination of more than one modality increases the probability that mothers attribute communication (Harding, 1984; Sugarman, 1984). For example, Harding (1984) found that when the infants looked at mother and reached for a toy, the mothers were highly likely to call the behavior communicative. Similarly, Lawrence (1984) found that many instances of vocalizations that were paired with looking at mother were called communicative. Based on these findings, "weak signals" were those infant behaviors exhibiting one modality; e.g., attention to toy only.

Although the tape was shown to mothers of both handicapped and nonhandicapped children, only a normally developing 12-month-old was selected to model these behaviors. The reasoning behind this decision was as follows: (a) The absence of a prototypically handicapped child creates a situation wherein mothers of handicapped infants would not necessarily be more familiar with an unfamiliar handicapped infant's cues than a normal infant's cues. (b) In fact, it was thought that the behaviors that a normal baby provides would be similar to behaviors given by both handicapped and nonhandicapped infants. The criteria used to select the specific infant to be taped for this measure were a) the infant must be in the pre-linguistic stage of communication development, b) the infant must exhibit communicative behaviors which vary in terms of their communicative clarity and obligation for a response, c) the infant must be 12 months old, and d) the infant must be developing normally. The adult to be taped was selected on the basis of her clinical skills in managing semi-structured elicitation protocols and for her excellent general rapport with children. Although the adult was not the infant's mother, the mothers' responses and verbal comments indicated that many of mothers in the sample assumed that the adult on the tape was the infant's mother.

The adult and child to be videotaped engaged in several activities that were designed to elicit a sample of behaviors that theoretically represent a range of communicative value. These activities were a) a semi-structured play session with various high-interest (e.g., bubbles, blocks) and wind-up (e.g, jumping bunny) toys and b) a structured snack time in which the infant chose and rejected various foods. Selected scenes evenly represented the range of clarity of communicative signal.

Once the 20 scenes were selected, they were edited to depict only one possibly communicative cue and to limit adult verbal interpretation of the behavior. Scenes were then randomly sequenced on the tape to be shown to the mothers. The selected infant behaviors included, but were not be restricted to, the behaviors measured from the subjects' free-play session. Table 4 describes the behaviors depicted in the videotape and gives an a priori rating of the communicative strength of each behavioral cluster. The purpose of this table is (a) to illustrate the types of behaviors the mothers were presented, (b) to demonstrate that the scenes represented a range of communicative strength, and (c) to demonstrate that the scenes were randomly sequenced on the videotape.

Place Table 4 about here.

The mothers were asked to view the standard tape at the center or in their homes, depending on what was most convenient for them. Before viewing the standard tape the mothers were told the following. "I'm going to show you 20 scenes that last about 5 - 10 seconds each. Each scene depicts a 12-month-old child and an adult playing together. I'll show you a scene, stop the tape, and give you time to answer three questions about the scene. You can see the scene as many times as you like. The first question asks if you think the child is communicating to the adult. In other words, if you were playing with this child and saw him do what he does in the videotaped scene, would you think he was communicating his feelings, thoughts, or wants? Some of the scenes show behaviors most people think are communicative and others few think

Table 4

Description and A Priori Rating of Communicative Strength of Infant Behaviors Depicted in Standard Videotape

Scene Number	A Priori Rating (R = 1-6; 1 = weakest)	Behavior Type Depicted: Attention to Object	Attention to Mother	Facial Expression	Vocalizations	Description
3	1	x				Reaches for obj.
6	1	x				Gazes at obj.
7	1	x				Reaches for obj.
11	1	x				Gets obj.
9	2	x		x		Plays with obj. and smiles.
13	2	x		x		Plays with obj. and smiles.
16	2	x		x		Reaches for balloon as it's blown up, surprise expressed.
Practice	3	x			x	Gets obj. and vocalizes
5	3	x			x	Vocalizes and reaches for obj.
14	3	x			x	Drops old toy, gets new toy, vocalizes.
15	3	x		x	x	Vocalizes, smiles, gets requested obj.
1	4	x	x			Gets obj., gazes to mother
2	4	x	x			Gazes to mother, manipulates obj.
12	4	x	x			Reaches for obj., looks to mother.
19	4	x	x			Manipulates deflated balloon, looks at mother.
8	5	x	x			Strained reach for obj., looks to mother, gives up.
10	5	x	x			Gets obj., very salient gaze to mother.
17	5	x	x			Hands obj. to adult without prompting.

Table 4 (Cont.)

Scene Number	A Prior Rating (R = 1-6; 1 = weakest)	Behavior Type Depicted: Attention to Object	Attention to Mother	Facial Expression	Vocalizations	Description
18	5	x	x			Reaches for obj., looks to mother, gives up.
20	6	x	x	x		Blows bubble, smiles, looks at mother.
4	6	x	x	x	x	Manipulates obj., smiles, gaze to mother, vocalizes.

are communicative. There's no one right answer so just indicate what you think is communicative. You answer the question by indicating yes or no and how sure you are of your response by circling the response that best describes your answer. Please indicate only one response per question. The second question is asking if you think the child is deliberately communicating with the adult. The classic example of a child communicating but not doing so on purpose is the newborn baby crying because he is hungry. The mother knows that his crying may mean he is hungry and thus feeds him, but few mothers believe the infant cries in order to get mother to feed him. The response format to this question is identical to the one used in the first question. The last question is asking you to tell us what message the child is communicating. Some find it easier to answer the question if they try to imagine what the baby may be thinking or feeling. Just write down what the child is communicating in the blank space provided." After reading the instructions, an example is given, and mothers are allowed to ask questions about the procedure before beginning.

The following format was used to present the questions the mothers answered:

1. Does the child's behavior communicate to the adult what he is thinking, feeling or wanting?

¶	¶	¶	¶	¶	¶
No. Sure.	No. Somewhat Sure.	No. Not Sure.	Yes. Not Sure.	Yes. Somewhat Sure.	Yes. Sure.

2. Is he deliberately communicating these thoughts to the adult?

¶	¶	¶	¶	¶	¶
No. Sure.	No. Somewhat Sure.	No. Not Sure.	Yes. Not Sure.	Yes. Somewhat Sure.	Yes. Sure.

3. What might the child be thinking or communicating?

The numbers 1-6 were assigned to the responses in questions 1 and 2. The response No. Sure was assigned the value of "1", and the response Yes. Sure was assigned the value of "6".

Figure 4 presents pilot data that verifies the assumption that mothers do vary with respect to their ratings of the communicative value of infant behaviors presented in the above described procedure.

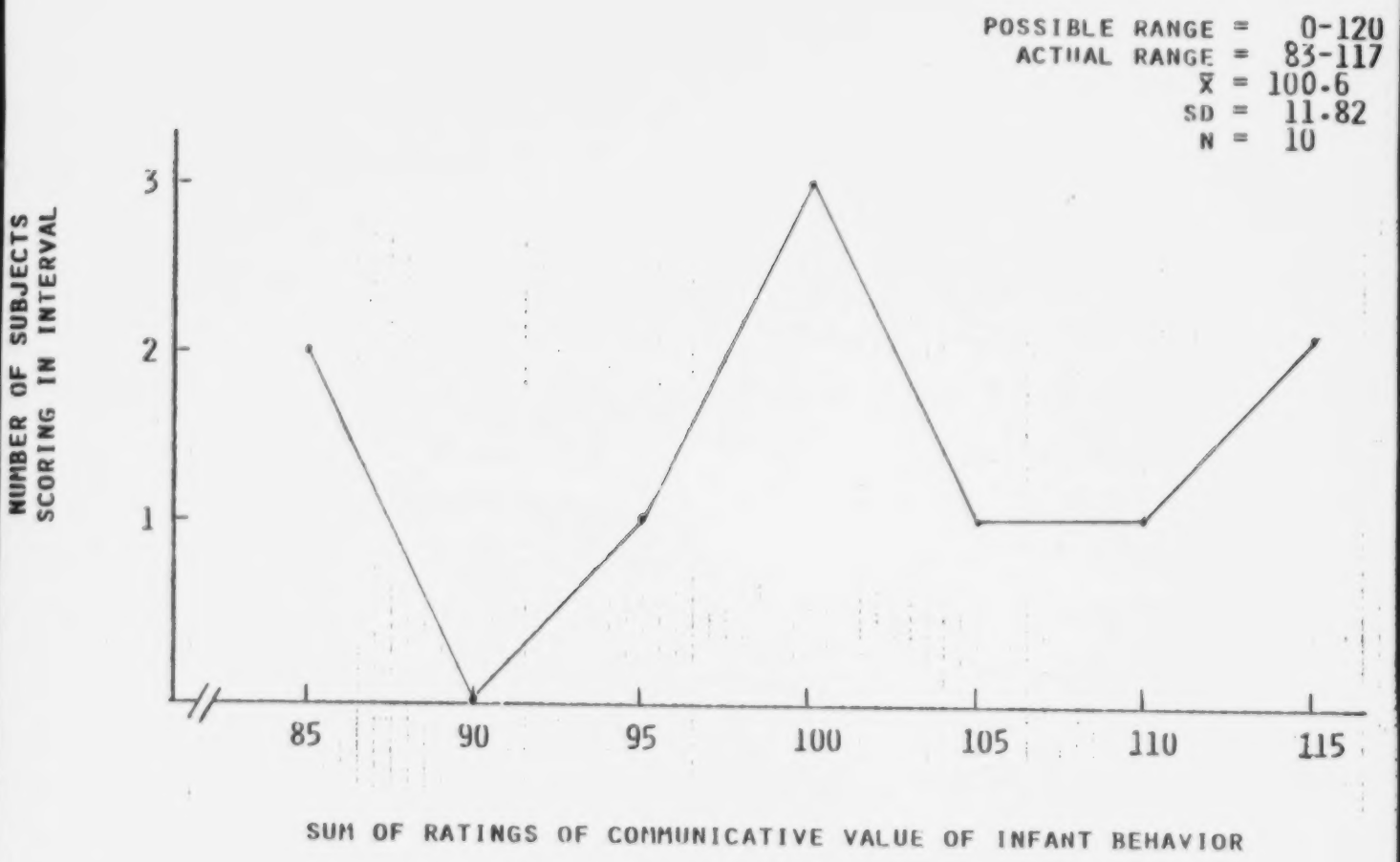
Place Figure 4 about here.

The across-item sum of the ratings to question number one were used as the measure of general maternal tendency to attribute communication (GMTAC) for two reasons. First, rating the general communicative value of a behavior more logically relates to the dependent measure since the dependent measure did not ask the mother to distinguish between intentional and unintentional communication. Second, the test-retest reliability of the first question was acceptable; whereas, that of the second question was not. The data from the second and third questions were not used for the purposes of this study.

The above procedure was selected for several reasons: a) The behaviors selected for the standard stimuli were determined by building on the data base of recently completed studies of maternal attributions of communication. b) By selecting behaviors that include those with a low probability of eliciting attributions, we can test if mothers of handicapped children are more or less likely to attribute communication

Figure 4

FREQUENCY DISTRIBUTION OF SUM OF ATTRIBUTION RATINGS



to behaviors that parents of normal infants rarely find communicative. c) By providing a standard set of behaviors to which the mothers are asked to attribute communication, we can infer that differences in the mothers' attribution of communication on this measure are due to differences within the mothers.

Generalization analysis of test-retest reliability on answers to questions one and two were estimated on eight randomly selected subjects, 25% of the total sample. Mothers were asked to repeat the procedure approximately six weeks after the first administration of the procedure. It was thought that this period was sufficiently long to prevent subjects from remembering their previous responses. The test-retest reliability estimate for the first question, i.e. rating the communicative value of the infant behavior, was .83 indicating acceptable stability of scores. However, the test-retest reliability estimate for the second question, i.e. rating the intentional communicative value of the infant behavior, was only .49 indicating the relative difficulty of this judgment. Therefore, only the scores to the first question were used in this study.

Summary of measurement of variables for the first study. Table 5 is a summary of variables used in the first study, the measurement procedure, and the nature of the data derived from this procedure.

Place Table 5 about here.

Table 5

Summary of Measurement of Variables for the First Study

Variable	Procedure	Nature of Data
Presence/absence of handicap	Phone intake interview	Nominal data
Degree of handicap	Movement Assessment of Infants	Summary risk score
Gaze to mother	Direct observation of taped 20' free-play	Frequency count
Gaze to toy	Direct observation of taped 20' free-play	Frequency count
Coordinated attention to mother and toy	Direct observation of taped 20' free-play	Frequency count
Vocalizations	Direct observation of taped 20' free-play	Duration
Mother's attribution of communication to her own baby's behavior (SFMAC)	Mother views herself playing with her infant. She indicates when she thinks her child is communicating	Frequency count
Mother's tendency to attribute communication to a standard set of stimuli (GMTAC)	Mother views selected scenes of a novel dyad playing. She rates each scene as to how communicative she considers the represented infant behavior.	Sum of ratings

Study 2

Purpose and Design of Second Study

The second study involved a behavioral coding of the segments of the mother-infant free-play session whose time of occurrence corresponded with those of the maternal attributions of communication. This approach allowed for a microanalytic analysis of the actual behavior that mothers called communicative and the relation of these communicative infant behaviors to preceding and following maternal behaviors. Sackett (1978) called such a strategy "discontinuous probe sampling". Sackett's use of the term "discontinuous probe" is used here to distinguish the more common method of sampling an entire free-play session from the method used in this study , which only sampled the behavioral context of the salient events: maternal attributions of communication.

The combination of the subjective measure of maternal attributions of communication and objective behavioral coding of interaction was uniquely suited to the purpose of the study. In general, this second study dealt with the nature of the infant behaviors that mothers identified as communicative and their behavioral contexts. The second study was more exploratory than the first in that specific predictions concerning the results were not made prior to the study. Specifically, the purposes were to provide (a) a test of the relation of degree of handicap to the nature of infant communicative behaviors, (b) a test of the relation of general maternal tendency to attribute to the nature of the behaviors mothers call communicative, (c) a description of the frequency with which mothers elicited these communicative infant

behaviors, (d) a test of the relation of degree of handicap to the frequency and nature of these elicitations, (e) a description of the frequency with which mothers responded to these communicative behaviors, and (f) a test of the relation of degree of handicap to the proportion of communicative behaviors to which mothers responded. As Hayes (1984) argued, microanalytic coding is appropriate to describing behaviors and their relation to a partner's behavior. However, when used alone, behavioral coding assumes that all behavior is equally important. Subjective data are needed to indicate what infant behavior is particularly salient and meaningful to the mother. Working back from the subjective data, coders identified the particularly salient and meaningful infant behaviors and described their relation to the mother's behavior. Within group and between group analyses were then done to better understand the effect that presence and degree of handicap has on the above listed aspects of the mother-child interaction.

Detailed Description of the Coding System Used in the Second Study

Defining the relevant communicative segment. A discontinuous sampling strategy requires that we have criteria concerning when to start and stop coding. Deciding when to start coding was not problematic since the time of occurrence of maternal attributions was synchronized with the time on the video tape. The coder simply began coding with the infant behavior(s) that changed at or very near this time of occurrence. Two coders were able to begin the relevant communicative segment within 2 seconds of each other on an average of 94% on six randomly selected subjects.

Deciding when to end this segment was more difficult. Mothers probably do not look at one behavior and call it communicative. They probably use several behaviors from which they derive meaning. Therefore, the investigator was faced with a challenge of selecting a meaningful end to the segment that allowed for several infant behaviors to occur. The investigator decided not to end the segment when the mother indicated that communication ended for two reasons. (a) The time of occurrence of cessation of communication was not reliable. (b) Often the infant's behavior did not change in any salient manner at the time mother indicated communication ended. The criteria for ending the segment should relate to infant behaviors that indicate that he is no longer communicating or has begun to communicate about a new topic. A temporal criteria for ending the segment was not used to avoid arbitrary segmenting of behaviors. The concept of an interactive episode met these criteria for ending the segment. An episode can be defined by interaction around a theme, e.g. a toy, social game, or specific way of playing with a toy. This "theme" is analogous to a "topic of conversation" in linguitic analysis. The end of an episode was defined as a change in the infant's focus of attention or type of action applied to a toy. This criteria is related to functional changes in the infant's behavior that other researchers have used to segment interactive episodes (Farran & Haskins, 1980). In the present study, the ending point, defined by this criteria, was compared to that given by the mothers as an informal validity check concerning whether this method of defining the relevant segment was meaningful to the mothers. This is a weak test of the construct validity of the investigator's

criteria for ending the communication segment because the criteria measure, the time of occurrence of when the mothers indicated the end of communication, was not reliable. In a random sample of six subjects, the mothers ended communication within five seconds of when the coder ended the relevant segment 57% of the time. Two coders ended the segment within three seconds of each other on an average of 74% of the time.

Describing infant behavior in the communicative segment. After defining the parameters of the communicative segment, trained observers indicated whether at least one instance of one or more of four behavior categories occurred within this segment. These classes of behavior were: (a) attention to object, (b) attention to mother, (c) vocalization, (d) other and unclear behaviors. These infant behaviors were coded for two reasons: a) The literature suggests that developmental shifts in how infants play and communicate can be seen in the frequency and co-occurrence of these behaviors. b) The behavior categories correspond to the infant behaviors coded in the first study, thereby allowing an analysis of the relation of the overall occurrence of the behavior to relative frequency with which mother calls the behavior communicative.

Conceptual and operational definitions for these behavior classes are as follows:

1. Attention to object: Deliberate and active attention to an object. This is operationalized by at least one of the following:

a. Sustained gazing at an object that is either visible on the tape or commented on by the mother.

b. Pointing to, reaching for, or crawling toward an object that is either visible on tape or commented on by the mother.

c. Active manipulation of an object that is visible on tape.

2. Attention to mother: Deliberate and active attention to mother. This is operationalized by at least one of the following:

a. Discrete gaze to mother's face as inferred through facial orientation and, if visible, gaze direction.

b. Handing or throwing an object to mother is scored under "attention to mother" and "attention to object".

c. Tugging or pulling at any part of mother's body or clothing.

3. Vocalization: Audible vocal sounds that may or may not be approximations to words. This is operationalized as the following:

a. Any movement of the vocal folds that produces phonation. E.g. cries, laughs, approximations to words, babbling, undiffereniated vocalizations.

4. Other: Communicative behavior is unclear or is not included in the above categories, e.g. gaze aversion, clapping hands, idiosyncratic gestures.

Coding presence and nature of elicitation of initial infant behavior. The observers coded whether and how the infant behavior that began the attribution was elicited by mother's behavior. Conceptually, an elicitation is the coder's judgment of that the preceding maternal behavior is related to changes in the form of the baby's behavior (e.g.

baby vocalizes or smiles) or changes in the baby's focus of attention (e.g. baby plays with new toy or looks at mother). Types of elicitations coded in this coding system were the following:

1. Talking to the infant that functions to change the infant's focus of attention or elicits vocal turn taking.
2. Manipulating an object in the infant's visual field that functions to change the infant's focus or nature of attention to an object.
3. Physically positioning or moving child that functions to change child's focus or nature of attention.

The order in which the above types of elicitation are listed reflect how proximal and directive these mother behaviors are. That is, it was assumed that the more distal, less intrusive behavior of talking to the infant was less directive than manipulating an object in the infant's field of vision which, in turn, was more distal and less directive than literally moving the infant's arm to perform an action. These distinctions were made to allow group and within sample analysis of the nature of maternal elicitations of communicative behavior.

Coding maternal response to behaviors in the relevant segment. As mentioned earlier, it is reasonable to assume that mothers do not attribute communication to a single behavior. Instead mothers probably use a cluster of infant behaviors to derive meaning. Consequently, there is no theoretical reason why mothers should respond to each and every component behavior. Therefore, the coders indicated whether the mother responded to any of the infant behaviors within the communicative

segment. This was a dichotomous code; i.e., presence or absence of maternal response to a communicative behavior was coded.

Conceptually, a response is maternal behavior that occurs after the communication behavior and relates to that communication behavior in form, meaning, or function. Although not discriminated in the coding system, each type of response is discussed below to help clarify the definition of maternal response used in the coding system. A response that is related to the form of the infant's behavior imitates the infant's actions or unintelligible vocalizations. A response that is related to the meaning of the infant's behavior (a) continues something the infant seems to like, (b) discontinues something the infant seems to dislike, (c) comments on something the infant did, or (d) verbally interprets the meaning of the infant's behavior. A response that is related to the function the infant's behavior plays in the interaction (a) fills an interactive turn, e.g. repeating a predictable event after the infant's action; or (b) acknowledges an infant's behavior, e.g. saying "hi" to the baby when he looks at mother. The reader is referred to the Appendix for a sample of a completed coding form.

Variables Derived from Discontinuous Probe Analysis

This section describes the variables derived from the above coding system. They are organized by the underlying construct that they were designed to measure. The selection rationale and interobserver reliability information is provided for each variable. Interobserver reliability estimates are all G-coefficients based on a random sample of four subjects from each sample (total reliability sample = 8), i.e. 25% of the total sample.

Nature of communicative signal. The variables that index nature of communicative signal were derived from the three infant behavior categories discussed in the section describing the coding system: attention to mother, attention to toy, and vocalizations. In all but one case, the variables based on various combinations of the three infant behaviors are not exclusive categories. The small number of attributions on which the variables were based did not allow sufficient variance, occurrence, or inter-observer reliability for mutually exclusive categories to be of use. However, the pattern of results indicated that most communicative segments contained two of the three target behaviors, thereby indicating that presence or absence of one of these three behavior categories would not be sufficient descriptors. Therefore, four types of categories were derived to indicate the pattern of solitary and combined occurrence of infant behaviors in the communicative segments. Table 6 provides a list of the variables used to index nature of communicative signal and their respective reliability coefficients.

Place Table 6 about here.

"Inclusive Behavior Categories" are categories indicating the proportion of communicative segments with at least one occurrence of the target behavior and any other nonspecified behavior that may have occurred in the communicative segment. These correspond to the overall occurrence of infant behaviors recorded during the free-play session in the first study. "Combined Behavior Categories" are categories

Table 6

Variables Indexing Nature of

Communicative Signal and Their Corresponding Reliability

Variable	Reliability Coefficient
Inclusive Behavior Categories	
% of Segments with Attention to Toy	.95
% of Segments with Attention to Mother	.95
% of Segments with Vocalization	.87
Combined Behavior Categories	
% of Segments with Attention to Toy and Vocalization	.87
% of Segments with Attention to Toy and to Mother	.95
% of Segments with Attention to Mother and Vocalization	.87
Behavior Categories Excluding One Behavior	
% of Segments with Attention to Mother Not Toy	.97
% of Segments with Attention to Mother No Vocalization	.59
Behavior Category Excluding All Other Behaviors	
% of Segments with Attention to Toy Only	.86

indicating the proportion of communicative segments with various combinations of these primary behavior types. "Categories Excluding One Behavior Type" confirm the general pattern with which behaviors were usually combined during communicative segments. The one "Category Excluding All Other Behaviors" represents the only exclusive category in which sufficient variance and number of instances were present.

Presence and nature of maternal elicitations of communicative behaviors. Based on Bruner's (1975) and Vygotsky's (1978) theory of the importance of the mother's role in eliciting and supporting effective infant behaviors, it is reasonable to assume that mothers of 11-month-olds elicit much of their infants' behavior, regardless of presence or degree of infant handicap. However, developmentally older children respond more frequently to distal stimuli than do developmentally younger children. Therefore, the coding system was designed to allow within-sample analyses of the relation of degree of handicap to the type of elicitations that the mothers used. It was reasoned that mothers of severely handicapped children may use elicitations that provided maximum direction to the child's behavior, e.g physically prompting a desired behavior. Alternatively, it was reasoned that mothers of mildly handicapped children would use more elicitations that were more distal and less directive, e.g. only talking about the object of interest. Therefore, the derived variables to address questions concerning elicitations are as follows:

1. Percentage of behaviors that began the communicative segment that are elicited. This was used to describe the frequency of maternal elicitations of communicative behaviors and to test within-sample

relation of degree of handicap and the proportion of communicative behavior clusters that were elicited. The interobserver reliability estimate for this variable was .89.

2. Percentage of elicitations that used physical prompting. This was used to test a within-sample relation of degree of handicap and maternal use of proximal and directive elicitations. The interobserver reliability estimate for this variable was .95.
3. Percentage of elicitations that used only vocalizations or speech to elicit the infant's behavior. This was used to test the relation of presence of handicap with maternal use of distal elicitations. The interobserver reliability estimate for this variable was .93.

Maternal responsiveness to communicative behaviors. Theory predicts that mothers respond to behaviors they call communicative. Therefore, this variable was collected to test this theory. The construct validity of the subjective measure of maternal attribution was tested by measuring whether the communicative infant behaviors were followed by maternal responses. Additionally, a within-sample analysis of the relation of degree of handicap and proportion of communicative behavior clusters to which mother responds was used to shed light on whether mothers of severely handicapped infants respond to communicative behaviors with a different frequency than do mothers of normal or mildly handicapped infants. This information is helpful in understanding why mothers of handicapped infants have been found to be more directive and less responsive than mothers of normal infants.

This variable is simply the percentage of relevant segments that contained behaviors to which mother responded. No distinctions were

made according to the type of response because coders were not able to make this discrimination reliably. Mothers of both reliability samples almost always responded to behaviors they called communicative resulting in very little variance in the scores. Since G-coefficients control for interobserver agreement due to low between-subject variance, the reliability estimate of .65 for this measure is only moderately high, but acceptable (Mitchell, 1979). The average percent agreement for this variable of .92 demonstrates the degree to which the G-coefficient controls for chance agreement.

Summary of Measures and Analysis Techniques Used to Address the Research Questions.

Table 7 summarizes the statistical analyses and variables used to address the research questions in both studies.

Place Table 7 about here.

Table 7

Relation of Questions to Measures and Analyses for Both Studies

Study 1

	Research Questions	Measures	Analysis
RQ1.	Is there a group difference regarding the frequency of maternal attributions of communication?	Group. Frequency of mother's attributions.	*t*-tests.
RQ2a.	Are the maternal and infant behavior factors positively related to frequency in maternal attributions (SFMAC)?	*Sum of ratings. Frequency or duration of infant behaviors. Frequency of mother's attributions.	Separate regressions for each sample.
RQ2b.	Does the maternal factor (GMTAC) account for more variance in the handicapped sample than in the non-handicapped sample?	Same as in RQ2a.	*z* test of group difference regarding regression coefficient for maternal factor.
RQ3.	Does degree of handicap relate to general maternal tendency to attribute communication (GMTAC)?	MAI risk score. *Sum of ratings.	Pearson's r for handicapped sample only.

*Sum of rating = sum of maternal ratings of communicative value of standard scenes.

Table 7 (Cont.)

Study 2

	Research Questions	Measures	Analysis
RQ4.	Does degree of handicap relate to nature of communicative signal?	MAI Nature of communicative behavior variables.	Separate regression for each dependent variable.
RQ5.	Is general maternal tendency to attribute communication (GMTAC) related to the nature of infants' communicative signals?	*Sum of ratings Nature of communicative behavior variables.	Separate regressions for each sample and variable.
RQ6a.	To what extent do mothers elicit communicative behavior clusters	% of attributions elicited.	Descriptive statistics by sample.
RQ6b.	Does degree of handicap relate to proportion of communicative behaviors mothers elicit?	MAI. % of attributions elicited.	Regression for handicapped sample.
RQ6c.	Does degree of handicap relate to type of elicitation mothers use?	MAI. % of elicitations using physical prompts. % of elicitations using only vocalizations or speech.	Regression for handicapped sample.

*Sum of rating = sum of maternal ratings of communicative value of standard scenes.

Table 7 (Cont.)

Study 2

	Research Questions	Measures	Analysis
RQ7a.	To what extent do mothers respond to the behaviors they call communicative?	% of segments to which mother responded.	Descriptive statistics by sample.
RQ7b.	Is there a relation between degree of handicap and maternal responsiveness to communicative behaviors.	MAI. % of segments to which mother responded.	Regression for handicapped sample.

CHAPTER III

Results

The presentation of the results is organized by study. The section for each study includes a) an overview of the purpose of the study, b) strategies used to maximize power of the statistical tests used in the study, c) strategies used to analyze non-normally distributed scores in the study, d) descriptives and group comparisons on variables used in the study, e) results relevant to the research questions of the study, and f) a summary of the findings of the study.

Study 1

Purpose of the 1st Study

The literature on mother-child interaction suggests that both mother and infant affect the form and nature of the interaction. It has been suggested also that mothers of handicapped children attribute communication less frequently than other mothers. The first study was designed to test and compare explanatory models for variance in the frequency of maternal attributions of communication among mothers of handicapped and nonhandicapped infants. These models included both maternal and infant factors. Three a priori hypotheses were tested: a) Mothers of nonhandicapped infants attribute communication to their own infants (SFMAC) more frequently than mothers of handicapped infants. b) The relative occurrence of potentially communicative infant behaviors and the general maternal tendency to attribute communication (GMTAC) are positively related to the frequency of maternal attribution of

communication to their own children's behavior (SFMAC). c) Degree of handicap is related to general maternal tendency to attribute (GMTAC) in the handicapped group. This study was based on a total sample of 32 dyads; 16 dyads in each group.

Maximizing Power of Statistical Tests

The relatively small sample size used in this study requires explicit attention to maximizing the power of statistical tests utilized to address the research questions. Three precautions were used to maximize the power of the tests.

The first precaution was to limit the number of variables used in each statistical procedure. For example, only one of the four infant behaviors was chosen to act as the infant behavior factor (i.e. coordinated attention) in the regression for the explanatory model. (See section discussing the explanatory model for details of this systematic selection procedure).

The second precaution was to use a covariate to reduce the error term in the multiple regression while regressing the dependent variable on the predictor of interest. The use of a covariate for such a purpose is reasonable if it is statistically and theoretically related to the dependent variable (Pedhazur, 1982). In the first study, the infant behavior factor with the strongest association with SFMAC was used as a covariate while regressing SFMAC on GMTAC. In this way, the significance of the relation of general maternal tendency to attribute (GMTAC) to frequency of maternal attributions (SFMAC) could be tested with a smaller error term. Theoretically, the relative frequency of a potentially communicative infant behavior should be related to the

frequency with which mother says the infant is communicating. Statistically, coordinated attention in the nonhandicapped group was significantly related to the frequency of maternal attributions.

The third precaution was to test directional a priori hypotheses with a one-tailed test of significance (Howell, 1982; Pedhazur, 1982). One-tailed tests are more powerful than two-sided tests because they test the significance of a difference or relation in only one direction (Edwards, 1985; Guilford & Fruchter, 1978). One-tailed tests of significance are appropriate if the hypothesis that is to be tested is a) made before collecting data and b) specifies the direction of the relation or difference (Howell, 1982). Two of the a priori hypotheses of the first study do specify the direction of the relation or difference. Therefore, a one-tailed *t*-test was used to test a) whether mothers of nonhandicapped infants attribute communication more frequently to their own children's behavior (SFMAC) than do mother of handicapped children and b) whether the relative occurrence of infant behaviors and the general maternal tendency to attribute (GMTAC) are positively related to the frequency of maternal attribution of communication (SFMAC). The danger of using one-tailed tests is that a relation or difference may exist, but in the opposite direction that was hypothesized (Guilford & Fruchter, 1978). However, the literature and logic suggested that the probability of this danger occurring with these two hypotheses was very low.

Analysis of Non-normally Distributed Scores

Since parametric tests are considered more powerful than nonparametric tests (Howell, 1982), these were used to address research

questions if the data met the assumptions for the procedures. However, the scores of both groups on two of the infant behaviors violated the assumption of normality of the distribution of dependent variable: "frequency of coordinated attention to mother and to toy" and "duration of vocalizations". The scores on the MAI in the nonhandicapped group were skewed also.

Simple correlations involving these skewed variables used the ranked form of the scores. If both variables in the correlation were skewed, a Spearman Correlation Coefficient was calculated and tested. If just one variable was skewed, a Pearson Product Moment Correlation was calculated using the ranked form of the skewed variable and the original form of the normally distributed variable.

Group comparisons using these scores as dependent variables were made using the Wilcoxon Rank-Sum Test (Howell, 1982). This nonparametric test allowed the comparison of distributions that were non-normal. The scores used in the comparison were the sum of the ranked scores regardless of group. The difference scores were tested for significance on a chi-square distribution.

Description of Variables Used in the First Study

Table 8 presents the means and standard deviations of variables used in the first study for both groups.

Place Table 8 about here.

The nonhandicapped group emitted more gazes to toy, $t(30) = 4.23$, $p = .0003$, and more instances of coordinated attention to mother and to

Table 8

Group Means and Standard Deviations on Variable in the First Study

Variables	Group	
	Handicapped (n = 16)	Nonhandicapped (n = 16)
Independent Variables		
Infant Behavior		
Frequency of Gazes to Toy	41.94 (22.57)	89.13** (38.42)
Frequency of Coordinated Attention to Toy & Mother	13.94 (5.88)	22.44+ (11.03)
Duration of Vocalization	160.05 (135.61)	65.63+ (45.25)
Frequency of Gazes to Mother	22.63 (12.46)	21.06 (12.05)
Maternal Tendency to Attribute	99.63 (8.65)	97.88 (12.16)
Movement Assessment of Infants (MAI)	32.60 (15.86)	8.19++ (5.06)
Dependent Variable		
Frequency of Maternal Attributions of Communication	21.63 (13.19)	23.25 (14.34)

** Group mean differences; $p < .01$ via t-test.
++ Group mean differences; $p < .01$ via Wilcoxon Rank-Sum Test.
+ Group mean differences, $p < .05$ via Wilcoxon Rank-Sum Test.

toy, chi square(1, N = 32) = 5.94, p = .02. The handicapped group emitted a greater total duration of vocalizations, chi square(1, N = 32) = 5.64, p = .02. These infant behaviors were chosen to index the relative frequency of occurrence of potentially communicative signals in the free-play session. Next the results of testing the three a priori hypotheses will be presented, the first of these deals with group differences in frequency of maternal attributions of communication to infant behaviors (SFMAC).

Group Differences in the Frequency of Maternal Attribution (SFMAC).

Research question: Are there group differences in the frequency with which mothers attribute communication to their own children's behavior (SFMAC)? It was predicted that mothers of nonhandicapped children would attribute communication to their babies' behavior more frequently than would mothers of handicapped children. In statistical terms, a main effect for group was tested.

Results. Group differences were tested with a one-tailed t-test. The prediction that mothers of nonhandicapped infants would attribute communication to their infants behavior more frequently than mothers of handicapped infants was not supported, t(30) = .33, p = .37. In fact, the means and standard deviations for the distributions of maternal attributions are very similar for the handicapped and nonhandicapped groups (M = 21.62, SD = 13.19; M = 23.25, SD = 14.34, respectively). The next question addressed the explanatory models for within-sample variance of frequency of maternal attributions.

Testing a Multivariate Model of Variance: Maternal Attribution in Handicapped and Nonhandicapped Dyads.

Research questions:

a. Are the general maternal tendency to attribute communication (GMTAC) and the relative occurrence of infant behaviors positively related to the frequency of maternal attribution of communication to their own babies' behavior (SFMAC) in samples of dyads with handicapped and nonhandicapped infants? It was predicted that both the relative frequency of infant behaviors in the free-play session and the sum of maternal ratings of a standard set of infant behaviors (GMTAC) would be positively related to the frequency of maternal attributions of communication in both samples. That is, main effects for both maternal and infant factors were tested.

b. Is the relative importance of these two factors different in a sample of handicapped infants when compared to a sample of nonhandicapped infants? It was predicted that mothers of handicapped infants would require a different model for explaining variance in maternal attributions, with general maternal tendency to attribute communication (GMTAC) playing a more important role than in the nonhandicapped model.

Results: The results indicate partial support of the hypothesized relations. A multiple regression technique was used to test a predictive model that used one infant behavior (coordinated attention) as a covariate, GMTAC as a predictor, and the frequency of maternal attributions of communication to her own child's behavior (SFMAC) as the

criterion variable. Assumptions of normality of the distribution of the dependent variable, normality of the distribution of residuals, and homoscedasticity were tested and found to be within acceptable limits. The statistical procedure used to test this question was a three step process.

The first step was to select the infant behavior that would function as the best covariate when regressing the dependent variable on the maternal factor. This was done by selecting the one infant behavior with strongest relationship to frequency of maternal attributions. Table 9 summarizes the Pearson correlations for the normally distributed variables of gaze to toy and gaze to mother and the Spearman correlations for the non-normally distributed variables of vocalizations and coordinated attention to mother and toy.

Place Table 9 about here

These results indicate that two infant behaviors were positively related to maternal attributions in the nonhandicapped sample only: coordinated attention to mother and to toy (Spearman's r = .74, p = .0005) and gaze to mother (r = .54, p = .015). These two infant measures tap greatly overlapping behavioral domains (Spearman's r = .82, p = .01). None of the four infant behaviors were significantly related to maternal attributions in the handicapped sample. Neither coordinated attention nor gaze to mother was significantly correlated to the other predictor, GMTAC (Spearman's r = .20; r = .07, respectively). Therefore both of these two behaviors were equally good covariates in the nonhandicapped

Table 9

Correlations of Infant Behaviors to Frequency of Maternal Attributions of Communication

Variables	Group	
	Handicapped (n = 16)	Nonhandicapped (n = 16)
Coordinated Attention to Mother and Toy	*r = .45 p = .08	*r = .74 p = .001
Gaze to Mother	r = -.10 p = .35	r = .54 p = .015
Gaze to Toy	r = -.03 p = .46	r = -.04 p = .44
Vocalization	*r = .05 p = .43	r = .05 p = .42

* Spearman's r
p values tested for significance via one tailed t-test.

sample. Given that coordinated attention was most strongly related to frequency of maternal attributions (SFMAC) in the handicapped sample, albeit not significantly so, coordinated attention was selected as the infant behavior to be used as the covariate in the major regression models for both groups (see step 3).

The second step was to determine if the major regression model required separate or pooled groups. Multiple regression was used to test differences in the slope of the regression line that predicted frequency of maternal attributions (SFMAC) from infant behavior and group membership. It was determined that slopes of the regression lines for each group were not significantly different, $t(31) = .07$, $p = .94$). However, Box's Max F indicates that variance on instances of coordinated attention was heterogeneous, max $F(15,15) = 3.51$, $p = .02$. Additionally, group scores on coordinated attention showed almost mutually exclusive ranges (handicapped $R = 6 - 25$, nonhandicapped $R = 8 - 46$). Therefore, regressions based on pooled groups would be misleading due to subgrouping and violations in assumptions of the statistical procedure. Consequently, separate regression models were needed for each group.

The third and final step was to test if the sum of maternal ratings of a standard set of infant behaviors (GMTAC) predicted frequency of attribution of communication to their own children's behavior (SFMAC) above and beyond that accounted for by the number of instances of coordinated attention. The main regression for the nonhandicapped group was significant ($R^2 = .36$, $p = .05$) because the infant behavior was significantly related to the frequency of maternal attributions (SFMAC). However, the main regression for the handicapped group was not

significant (R^2 = .28, p = .11). The separate regressions indicated that general maternal tendency to attribute (GMTAC) was not significantly related to the frequency of maternal attributions to their own children's behavior (SFMAC) in either group. However, there was a suggestive trend toward a positive relation of GMTAC and SFMAC (r = .40, p = .065) in the handicapped group even without a significant covariate to reduce the error term. In contrast, GMTAC had almost no relation to SFMAC in the nonhandicapped group even with a significant covariate (partial r = .002, p = .49). The next section tests the last a priori hypothesis of a relation between degree of infant handicap and GMTAC in the handicapped sample.

Severity of Infant Handicap in Relation to GMTAC:

Research question: Is degree of handicap related to general maternal tendency to attribute communication (GMTAC) in the handicapped sample? It was predicted that the degree of handicap (as measured by the MAI) would be related to handicapped mothers' general tendency to attribute (as measured by the sum of their ratings of a standard set of unfamiliar infant behaviors).

Result. A Pearson correlation procedure was performed only on the handicapped sample's scores to derive an index of association. A z-test was used to determine if this index was significantly different from 0. Both the MAI and the maternal ratings (GMTAC) were normally distributed and a linear relationship was found thus meeting the assumptions for the tests. As predicted, the results indicate that there was a significant positive relation between degree of handicap, as indexed by the MAI, and general maternal tendency to attribute (GMTAC), as indexed by the sum of

maternal ratings of a standard set of infant behaviors (r = .59; p = .02). That is, mothers of more severely handicapped children tended to attribute communication more freely than did mothers of less handicapped children.

Summary of Results of the First Study

The purpose of the first study was to test a model for explaining variance of frequency of maternal attribution of communication (SFMAC) in a sample of mother-child dyads with handicapped and nonhandicapped children. Following is a summary of the results of this first study.

Before testing the hypotheses, descriptives of the infant behaviors were presented. It was pointed out that the nonhandicapped infants emitted more gazes to toy and more instances of coordinated attention to mother and to toy during the free-play session. The handicapped infants emitted a greater total duration of vocalizations during free-play. Afterwards, the results of testing the three a priori hypotheses were presented.

First, it was predicted that mothers of nonhandicapped infants would attribute communication more frequently (SFMAC) than mothers of handicapped infants. This hypothesis was not supported.

Second, it was predicted that separate regression models would be necessary to account for variance in the frequency of maternal attributions (SFMAC) in each sample and that the selected infant behavior factor and general maternal tendency to attribute factor (GMTAC) would be positively related to SFMAC. Additionally, it was predicted that GMTAC would be more important in predicting SFMAC in the handicapped sample than in the nonhandicapped sample. These hypotheses

were partially supported. As predicted, there was a need for separate explanatory models for each group. As predicted, there was a positive relation between coordinated attention and frequency of maternal attributions in the nonhandicapped sample. However, no infant behavior was significantly related to frequency of maternal attributions (SFMAC) in the handicapped group. Although GMTAC was not a significant predictor in either group, in the handicapped group, a suggestive positive trend was present despite the absence of a covariate to reduce the error term. In the nonhandicapped group, no relation was found between GMTAC and SFMAC despite the presence of a covariate to reduce the error term.

Third, it was predicted that degree of handicap would be significantly related to general maternal tendency to attribute communication (GMTAC) in the handicapped group. This hypothesis was supported. A positive relation was found.

The first study looked at hypotheses dealing with the frequency of maternal attributions. The second study looked at questions dealing with the nature of the behaviors to which mothers attributed communication.

Study 2

Purpose of 2nd Study

While study 1 tested a priori hypotheses, study 2 was more exploratory in its approach to investigating its research questions. The second study had two main purposes. The first purpose was to test whether characteristics that the mothers and infants brought to the interaction were related to the nature of the behavior mothers called communicative. The research questions that were relevant to the first purpose were: a) Is there a relation between degree of handicap and type of infant behavior mothers call communicative? b) Is there a relation between general maternal tendency to attribute communication (GMTAC) and type of infant behavior mothers call communicative? The second purpose was to describe the mothers' roles of eliciting and responding to these communicative behaviors during the interaction and to test the relations of these elicitations and responses to degree of infant handicap. The research questions relevant to the second purpose were: a) To what extent do mothers elicit the behaviors they call communicative? b) Is the frequency with which they elicit these behaviors related to degree of infant handicap? c) Is the nature of these elicitations related to degree of handicap? d) To what extent do mothers respond to behaviors they call communicative? e) Is the frequency with which they respond to these behaviors related to degree of handicap?

In study 2, the scores for the dependent measures were proportions, e.g. the percent of communicative segments that contained attention to mother. Since these proportions would be inflated if based on a small number of attributions, the analyses for study 2 were based on data for mothers who made at least five attributions. This rule resulted in

dropping one subject from each sample who had two and three attributions respectively. The remaining subjects in the handicapped group (n=15) all had ten or more attributions. The remaining subjects in the nonhandicapped group (n=15) all had eight or more attributions.

Maximizing the Power of Statistical Tests

Two precautions were taken to maximize the power of statistical tests carried out on these small samples. First, the number of variables in each statistical procedure was limited. This is seen in the use of separate regressions for each dependent variable indexing nature of communicative behavior.

Second, if significantly related to the dependent variable, the variable "number of communicative segments" was used as a covariate to reduce the error term, thereby increasing the power of the regressions. In this study, none of the dependent variables were related to the number of segments in the nonhandicapped group. Three variables were negatively related to the number of segments in the handicapped group: a) percentage of segments that contained attention to mother (partial r = -.47; p = .02), b) percentage of segments that contained attention to mother and to toy (partial r = -.43; p = .01), and c) percentage of segments that contained attention to mother, but no vocalization (partial r = -.30; p = .04). Therefore, regressions using these three variables were carried out after statistically controlling for the number of segments. All other regressions were simple regressions; i.e. regressions utilizing a single predictor and no covariate.

Procedures for Analyzing Non-normally Distributed Variables

Several of the dependent variables in the second study were not normally distributed. Variables that were skewed were proportions of

segments that contained the following target behaviors: a) attention to toy, b) attention to toy and vocalization, c) attention to toy and to mother, d) attention to mother and vocalization, e) attention to mother, not to toy, and f) attention to mother, no vocalization. Two categories indexing nature of communicative segment were normally distributed in both samples: a) attention to mother and b) vocalization. Additionally, the distribution of proportions of elicitations using physical prompts and those using only spoken prompts was skewed in both groups. Finally, the distribution of proportions of segments to which mothers responded was also skewed in both groups.

In the case of within-sample analyses, scores of non-normal dependent variables were ranked; and this form of the variable was used in the regressions. Log and arcsine transformations were also carried out without adequate results. That is, although transforming the data to ordinal data results in the loss of information, only rank transformations resulted in rectifying the violation of the assumption of normality. In all but one case, group comparisons of non-normal variables were carried out using Wilcoxon's Rank-Sum Test. (See section on analyzing non-normally distributed variables of 1st study for description of Wilcoxon's Rank-Sum Test). In the one exception, the within-group variance was very limited thus creating a situation in which Wilcoxon's Rank-Sum Test would be a very weak test of group differences. Therefore, a Median test was used to test group differences on this variable. (See section on maternal elicitations of communicative behaviors for more detailed description of Median test and the rationale for its use).

Description of the Groups on Dependent Variables of Second Study

Several variables that were used in the first study were also used in the second study. These variables were a) the four infant behaviors recorded from the free-play session, which are used to index the overall occurrence of potentially communicative behaviors during the mother-infant interaction session; b) the MAI, which is used to index degree of handicap; and c) the sum of maternal ratings of a standard set of an unfamiliar infant's behaviors, which is used to index general maternal tendency to attribute (GMTAC). Descriptive statistics on the dependent variables unique to the second study are presented below. The nature of communicative behavior variables describe the segments that mothers called communicative. Additionally, these results indicate how groups differed with respect to the presence and nature of maternal elicitations of these behaviors as well as the presence of maternal responses to these behaviors. Table 10 lists these variables and their means and standard deviations.

Place Table 10 about here.

In all but one case, the variables indexing the nature of communicative segments are not exclusive categories. The small number of attributions on which the variables were based did not allow sufficient variance, occurrence, or inter-observer reliability for mutually exclusive categories to be of use. The name of the variable indicates which behavior(s) the coder observed in the target segment; other behaviors may or may not be present also. The "inclusive categories" allow general descriptions of behaviors considered

Table 10

Group Means and Standard Deviations on Dependent Variables of the Second Study

Variables	Group	
	Handicapped	Nonhandicapped
Nature of Communicative Segments		
Average duration of segment	9.4	7.73
	(5.08)	(3.23)
Average number of communicative behaviors in segment	1.69	1.81
	(.25)	(.35)
Inclusive Behavior Categories		
% of segments w/ attention to toy	76.00	96.80 **
	(22.99)	(5.25)
% of segments w/ attention to mother	48.93	44.73
	(26.09)	(26.38)
% of segments w/ vocalizations	46.07	42.00
	(23.16)	(22.83)
Combined Behavior Categories		
% of segments w/ attention to toy + voc	28.53	40.47
	(19.70)	(22.40)
% of segments w/ attention to toy + mother	26.93	40.60
	(20.77)	(24.12)
% of segments w/ attention to mother + voc	26.00	16.60
	(21.07)	(15.85)
Behavior Categories Excluding One Behavior		
% of segments w/ attention to mother - not toy	22.80	1.98 **
	(22.82)	(3.49)
% of segments w/ attention to mother - no voc	24.12	28.43
	(17.08)	(17.69)
Behavior Category Excluding All Other Behaviors		
% of segments w/ attention to toy only	25.00	29.80
	(17.74)	(23.08)

** Between-group mean differences; p = .01; Wilcoxon Rank-Sum Test.

Table 10 (continued)

Variables	Group	
	Handicapped	Nonhandicapped
Presence of Maternal Elicitations of Segments		
% of segments elicited	64.47 (28.42)	58.13 (25.13)
Nature of Maternal Elicitations of Segments		
% of elicitations using physical prompts	28.50 (25.85)	1.23 ** (3.11)
% of elicitations using spoken prompts only	17.57 (19.74)	34.08 + (26.28)
Presence of Maternal Responses to Segments		
% of segments to which mother responded	90.00 (12.40)	87.80 (10.50)

** Between-group mean differences; $p < .01$; Wilcoxon's Rank-Sum Test.
+ Between-group mean differences; $p < .05$; Median Test.

communicative without regard to what other behaviors may also have been included in the segment. Since usually only two of the three main behavior types were included in a communicative segment, the "combined behavior categories" indicate which infant behaviors were usually combined during the communicative segments. The "categories excluding one behavior type" confirm the general pattern with which behaviors were usually combined during the communicative segments. The one "category excluding all other behaviors" is the proportion of segments that contained attention to toy only. This was the only exclusive category in which sufficient variance and number of instances was present.

The average length of the communicative segments for the handicapped and nonhandicapped sample was approximately nine and eight seconds, respectively. During the typical segment, two communicative behaviors usually occurred. In both groups, the majority of segments contained infant attention to an object; but mothers of nonhandicapped infants ($\underline{M}$ = 96.8) identified communicative segments that contained attention to objects more frequently than did mothers of handicapped infants ($\underline{M}$ = 76), chi square(1, $\underline{N}$ = 30) = 10.21, $\underline{p}$ = .001. The greater proportion of communicative segments with attention to toys in the nonhandicapped sample is also seen in the relatively low standard deviation when compared to that of the handicapped sample ($\underline{SD}$ = 5.25; 22.99, respectively). Although not significantly different, there was a suggestive trend that nonhandicapped infants' communicative segments contained greater proportions of attention to toy accompanied by vocalizations ($\underline{M}$ = 40.47) and accompanied by attention to mother ($\underline{M}$ = 40.60) than those contained in the handicapped infants' segments ($\underline{M}$ = 26.93; 28.53, respectively). Attention to mother was seen in about half

of the segments in both samples. In the nonhandicapped sample, attention to mother was usually combined with attention to toy, $t(13) = 2.19$; $p = .05$). In the handicapped sample, there was a greater proportion of segments with attention to mother without attention to toy, chi square(1, $N = 30$) = 12.16, $p = .0005$. Additionally, about half of the communicative segments in both samples contained vocalizations. In the nonhandicapped group, these vocalizations were usually combined with attention to toys, $t(13) = 2.30$, $p = .04$; whereas, in the handicapped group, vocalizations were combined with attention to toys and with attention to mother with about the equal frequency, chi square(1, $n = 15$) = .14; $p = .73$. In summary, communicative segments in the handicapped group contained fewer instances of attention to toys regardless of whether it was accompanied by attention to mother or by a vocalization.

Varying length of communicative segment as a possibly confounding factor: The coding system for the above variables used a unit of analysis based on the infant's focus of attention. This resulted in communicative segments of varying length, depending on when the infant shifted his focus of attention. Therefore, if the length of these segments varies systematically with presence or degree of handicap, any group differences or associations between nature of communicative behavior and degree of handicap could be artifacts of the coding system. However, this does not appear to be the case with these data. The mean length of segment does not differ between the two groups, $t(28) = .74$; $p = .27$. In addition, the relation between degree of handicap and length of communicative segment was not significant ($r = .45$; $p = .10$). However, since this relation may be significant with a larger sample, a

second coding of the videotapes was done using a fixed segment length to further demonstrate that varying the length of the segment did not affect the results systematically.

The second coding used a fixed segment length of five seconds. Five seconds represented the shortest average segment length as defined by the infant's focus of attention. The shortest average segment length was chosen to minimize the inclusion of irrelevant behavior types. Table 11 shows a comparison of the descriptive statistics by group on both coding systems.

Place Table 11 about here.

The within-group mean scores were very similar and the pattern of significant differences between groups was identical regardless of whether the coding system used a behavioral or a temporal definition for ending the communicative segment.

Relation of nature of communicative segments to overall occurrence of potentially communicative behaviors: The data were analyzed to test whether these proportions reflect the overall frequency with which the component behaviors were emitted during the observation period. This question can be addressed indirectly by examining the relationship of the inclusive behavior categories to the occurrence of presenting infant behaviors during the entire 20-minute free-play session. Although the proportions were derived from only the first 10 minutes of this session, these data provide an index of the relation between these two sets of variables. Table 12 details the results.

Table 11

A Comparison of Group Means on Data
From Two Coding Systems

Variables (% of Segments w/ Target Behaviors)	Coding Systems: Varying Length Segment H (M)	Varying Length Segment NH (M)	Fixed Length Segment H (M)	Fixed Length Segment NH (M)
Inclusive Behavior Categories				
Attention to Toy	**76.0	96.8	**72.4	100.0
Attention to Mother	48.9	44.7	45.0	42.0
Vocalization	47.0	42.0	43.8	42.0
Combined Behavior Categories				
Attention to Toy + Voc	28.5	40.5	22.4	38.7
Attention to Toy + Mother	26.4	40.6	20.4	39.2
Attention to Mother + Voc	26.0	16.6	19.1	15.8
Behavior Categories Excluding One Behavior				
Attention to Mother - not Toy	**22.8	1.9	**21.8	0.0
Attention to Mother - no Voc	25.9	26.3	24.1	28.4
Behavior Category Excluding All Other Behaviors				
Attention to Toy Only	25.0	29.1	25.2	28.3

** Between-group mean differences; $p < .01$; Wilcoxon Rank-Sum Test.

Table 12

Correlations of Selected Variables Indexing Nature of Communicative Segment and Overall Occurrence of Potentially Communicative Infant Behaviors

Handicapped Group

Percentage of Communicative Segments w/ Target Behaviors	Overall Occurrence of Infant Behaviors			
	Gaze to Toy	+Vocal-ization	Gaze to Mother	+Coordinated Attention
Inclusive Behavior Categories				
+Attention to Toy	.80***	-.58**		
Vocalizations	-.45*	.60**		
Attention to Mother	-.51**			-.46*
Combined Behavior Category				
+Attention to Mother & Voc	-.68***	.60**	.47*	-.56**

Nonhandicapped Group

Percentage of Communicative Segments w/ Target Behaviors	Overall Occurrence of Infant Behaviors			
	Gaze to Toy	+Vocal-ization	Gaze to Mother	+Coordinated Attention
Inclusive Behavior Categories				
+Attention to Toy				
Vocalizations		.88***		
Attention to Mother			.44*	.58**
Combined Behavior Categories				
+Attention to Toy & Mother				.57**
+Attention to Toy & Voc		.85***		

\+ Ranked scores used in correlation.
* $p < .10$
** $p < .05$
*** $p < .01$

Place Table 12 about here.

In the handicapped sample, the inclusive behavior categories were positively related to the overall occurrence of the behaviors during free-play. The proportion of communicative segments with attention to toy and those with vocalization are both positively related to the overall occurrence of their respective component behaviors (in order, r = .80; p = .0003; Spearman's r = .60; p = .02). However, the proportion of segments with attention to mother was not related to the overall occurrence of gazes to mother. Additionally, the proportion of segments with attention to mother was positively related to its component behaviors when it was accompanied by vocalizations (r = 47; p = .08; Spearman's r = .60; p = .02, respectively).

In the nonhandicapped sample, the inclusive categories also were related positively to the overall occurrence of the target behaviors during the free-play session. The proportion of segments with vocalizations were positively related to the overall occurrence of vocalizations during free-play (Spearman's r = .88; p = .001). There was a suggestive trend toward a positive relation between the proportion of segments with attention to mother and the overall occurrence of gazes to mother during free-play (r = .44; p = .10). Additionally, the proportion of segments with attention to mother was positively related to the overall occurrence of coordinated attention to mother and to toys (Spearman's r = .58; p = .02). The proportion of segments with attention to toy was not related to the overall of occurrence of any of the four target behaviors. However, when attention to toy was

accompanied with attention to mother, it was positively related to the overall occurrence of coordinated attention to mother and to toy (Spearman's r = .57; p = .02). Likewise, when attention to toy was accompanied by vocalizations, it was positively related to the overall occurrence of vocalizations (Spearman's r = 87; p = .0001).

In summary, the inclusive category describing segments with vocalizations reflected the overall frequency of vocalizations in the free-play sessions in both samples. In the handicapped sample, the proportion of segments with attention to toy reflected the overall frequency of gazes to toy. In contrast, in the nonhandicapped group, the inclusive category of proportion of segments with attention to toy was not related to the overall occurrence of gazes to toy. But the combined categories of segments with attention to toy that were combined with vocalizations or with attention to mother were related to the overall occurrence of at least one of their component behaviors. In the nonhandicapped group, the inclusive category of proportion of segments with attention to mother reflected the overall occurrence of coordinated attention during free-play. In contrast, in the handicapped group, the inclusive category of the proportion of segments with attention to mother was not positively related to the overall occurrence of any of the four target behaviors during free-play. However, when combined with vocalizations, attention to mother was related to the overall occurrence of its component behaviors. These data indicate ways the nature of the communicative segments differed between-groups. The next section indicates how the communicative segments differed within the handicapped group.

Relation of Degree of Handicap to the Nature of Behaviors Mothers Called Communicative

Research question: Does degree of handicap relate to the type of behaviors that mothers call communicative when viewing interaction with their own children? That is, within the handicapped group, do scores on the MAI relate to the proportion of communicative segments that contain specified target behaviors?

Results. The results indicated that the MAI was significantly related to several variables indexing the nature of the communicative signal. These regressions were based on 14 subjects (one moderately handicapped subject's MAI score was missing). The inclusive category of "attention to mother" was positively related to MAI when the covariate of "number of segments" was included in the regression (partial r = .45, p = .02). That is, after controlling for the number of communicative segments, mothers of severely handicapped infants identified a higher proportion of communicative segments that contained attention to mother than did mothers of less severely handicapped infants. More specifically, these severely handicapped children's communicative segments contained more instances of attention to mother when accompanied by a vocalization (r = .54, p=.05). In contrast, the MAI was negatively associated with the ranked proportion of segments that contained only attention to toy (r = -.52, p=.05). That is, the communicative segments of the severely handicapped children contained a lower proportion of behaviors that showed attention to toy only.

In summary, the more severe the handicap, the more likely the children's communicative segments were to contain attention to their mothers plus vocalizations, and the less likely they were to contain

only attention to toys. The results of this section indicated a relation between a characteristic that handicapped infants bring to the interaction and the nature of the behaviors their mothers called communicative. The next section investigates the effect of a maternal characteristic on the nature of these communicative segments.

Relation of GMTAC to the Nature of Behaviors Mothers Called Communicative.

Research question: Is a general maternal tendency to attribute communication (GMTAC) related to the types of behaviors mothers call communicative? That is, within each group, does the sum of maternal ratings of a standard set of unfamiliar infant behaviors (GMTAC) relate to the proportion of communicative segments that contain specified target behaviors?

Results. In the nonhandicapped sample, no variables indicating the nature of communicative behavior were related to the sum of maternal ratings of standard scenes (GMTAC). However, in the handicapped sample, two variables were positively related to the sum of maternal ratings (GMTAC) after controlling for number of segments: percentage of communicative segments that contained attention to mother (partial r = .41, p = .01) and percentage of communicative segments that contained attention to mother and to toy (partial r = .28, p = .05). That is, given an equal number of attributions, the mothers of handicapped infants who attributed communication more freely also tended to identify a greater proportion of communicative segments that contained attention to mother. These instances of attention to mother were often accompanied by attention to toy.

In summary, GMTAC was not related to the nature of behaviors mothers called communicative in the nonhandicapped sample. In the handicapped sample, the more freely the mothers tended to attribute communication, the more likely they were to have identified communicative segments with attention to mother that were accompanied by attention to toy.

These first two research questions dealt with factors mothers and infants brought to the interaction that affect the types of behaviors mothers call communicative. The next two research questions deal with the mothers' roles during the interaction.

Maternal Elicitations of Infant Communicative Behavior

Research questions:

a. To what extent do mothers elicit the behaviors they call communicative?

b. Does the degree of handicap, as indexed by the MAI, relate to the proportion of communicative behavior clusters that mothers elicit?

c. Does the presence or degree of handicap, as indexed by the MAI, relate to the nature of these elicitations? That is, do mothers of severely handicapped children use a greater proportion of elicitations that provide maximum direction to their children's actions? Conversely, do mothers of normal or mildly handicapped children use a greater proportion of more distal and less directive elicitations?

Results: Mothers did elicit over half of the behavior clusters they called communicative (handicapped $\underline{M}$ = 64%; nonhandicapped $\underline{M}$ = 58%). That is, as a group, the mothers of both samples elicited the majority

of the behavior clusters they called communicative. Table 10, in the section on describing the groups on variables of the second study, provided the univariate descriptive statistics for this variable.

A regression of the proportion of elicited communicative behavior clusters on the MAI indicated a nonsignificant relation between these variables (r = .36, p = .75). This information corresponds with the descriptive statistics in suggesting that mothers elicited their babies' communicative behavior regardless of presence or degree of handicap.

However, degree and presence of handicap, was related to the nature of the elicitations mothers used. Since the scores for these variables were proportions based on the number of elicitations, only those subjects with five or more elicitations were used. This further reduced the handicapped sample to 14 subjects. A within-handicapped sample regression was utilized to test the relation of the proportion of elicitations using physical prompts with the MAI. Despite the small sample, a significant positive relation was found (r = .65, p = .03). This variable was derived to measure a type of elicitation that was more highly directive of the child's action. The second variable derived to index nature of elicitation was the proportion of elicitations using only vocal or spoken prompts. This variable was derived to index elicitations that gave minimal direction and were more distal in nature. On this variable, four of the 14 subjects scored 0. The remaining 10 subjects showed very little within-group variance. Therefore, a within-group analysis was not appropriate. A between-group analysis that tested the significance of differences of central tendency was employed as a test of handicapped vs. nonhandicapped group differences in the proportion of maternal elicitations using this distal form of

prompting. After eliminating subjects in the normal sample with less than 5 elicitations, the normal sample for this analysis was reduced to 13. With unequal sample sizes and heterogeneous variance on this variable (max $F(12,13) = 3.18$, $p = .05$), a t-test on ranked or original data was not an appropriate test of group differences (Kirk, 1982). Therefore, a Median Test was used to test whether signficantly more of the subjects' ranked scores in one group fell under the grand median for the pooled sample. Mothers of nonhandicapped infants ($M = 34.08$) used significantly greater proportions of elicitations that were only spoken prompts than did mothers of handicapped infants ($M = 17.57$, chi square$(1, N = 27) = 4.30$, $p = .04$).

In summary, regardless of presence or degree of handicap, the mothers did elicit most of the behaviors they called communicative. But mothers of more severely handicapped children used more directive prompts of their babies' actions (i.e., physical prompts) than did mothers of less handicapped children. In contrast, mothers of nonhandicapped infants used more distal and less directive forms of elicitations (i.e, spoken prompts only). The next section indicates whether the mothers responded to infant behaviors they called communicative.

Maternal Responses to Communicative Segments

Research questions:

a. To what extent do mothers respond to behaviors they call communicative?

b. Does degree of handicap relate to the proportion of communicative segments to which mothers respond? That is, in the handicapped sample, is the MAI significantly associated with

the proportion of communicative segments to which mothers respond?

Results: Descriptive statistics in Table 12, in the section on describing the groups on variables of the second study, indicated that the mothers of handicapped and nonhandicapped infants responded to almost all of the behavior clusters they called communicative (M = 90% and 87.8%, respectively). The distributions of the proportions were positively skewed in both groups. In fact, four subjects in each group responded to 100% of the segments they called communicative.

Within the handicapped sample, the MAI was positively related to the proportion of communicative segments to which mothers responded (r = .56, p = .04). That is, the mothers of the severely handicapped infants tended to respond to a greater proportion of their infants' communicative segments than did mothers of mildly handicapped children.

In summary, mothers of both groups responded to almost all of the segments they called communicative. However, mothers of severely handicapped infants tended to respond to an even greater proportion of the communicative segments than did mothers of mildly handicapped infants.

Summary of Results from Both Studies.

In the first study, it was found that there were group differences on potentially communicative infant behaviors. Despite these differences, there were no group differences in the frequency of maternal attributions of communication to their infants' behavior (SFMAC). However, results of the predictive models indicated that the infant behavior factor was a significant predictor only in the nonhandicapped sample. In contrast, the results of the predictive model

for the handicapped sample indicated a noteworthy, albeit statistically nonsignificant, association of only the general maternal tendency to attribute factor (GMTAC) and the frequency of maternal attributions (SFMAC). That is, the infant behavior factor was not a significant predictor in the handicapped sample. Accompanying this finding, was the positive association of the maternal factor and degree of handicap. That is, the mothers of the more severely handicapped infants tended to attribute communication more freely.

In the second study, it was found that handicapped mothers' general tendency to attribute (GMTAC) was positively associated with the nature of the behaviors they called communicative. In the handicapped group, general maternal tendency to attribute (GMTAC) was positively related to the proportion of communicative segments that contained attention to mother and to toy. In the nonhandicapped group, general maternal tendency to attribute communication (GMTAC) was not related to the types of behaviors mothers called communicative.

There were several significant relations between degree of handicap and the types of behaviors that mothers of the handicapped infants called communicative. The more severely handicapped infants had segments with more attention to mother that was accompanied by a vocalization and less attention to toy only. This pattern of results is consonant with the descriptive group statistics that indicated that the handicapped group showed a trend toward a greater proportion of segments with attention to mother and vocalizations and a lower proportion of segments with attention to toy. As the data in Table 12 indicated, the proportion of segments with attention to mother and vocalization

reflected the overall occurrence of the potentially communicative infant behaviors in the free-play session.

Mothers of both groups elicited over half of the behaviors they called communicative. The mothers of severely handicapped infants used a greater proportion of highly directive elicitations, i.e., those that used physical prompts, than did mothers of less severely handicapped infants. While mothers of nonhandicapped infants used a greater proportion of more distal, less directive elicitations, i.e. those using only spoken prompts, than did mothers of handicapped infants.

As a group, mothers of both groups responded to almost all of the behaviors they called communicative. Within-handicapped group analysis showed that mothers of severely handicapped infants responded to communicative behaviors more frequently than did mothers of less severely handicapped children.

CHAPTER IV

Discussion

Introduction

The literature suggests that maternal attributions of communication are important, in part, because they may motivate mothers to respond contingently to their babies' behavior (Harding, 1982). This contingent responding may, at least, affect which behaviors mothers respond to (Golinkoff, 1984) and, at most, facilitate infant development of cause and effect relations (Kaye, 1982). Mothers of handicapped children have been reported to be less responsive during interaction (Bromwich, 1981 for review). It has been suggested that this alleged lower responsiveness may be due to a lower frequency of maternal attributions of communication (Dunst,1983). It is also possible that the directive style of many mothers of handicapped infants hinders their responsiveness to infant behaviors even if the mothers recognize them as communicative (Jones, 1977).

The purpose of the present study was to investigate several aspects of maternal attributions of communication in dyads with handicapped children. Although a sample of dyads with nonhandicapped infants at the same chronological age was used as a comparison sample, the main thrust of the study was to investigate the relation of variables within the handicapped sample. Specifically, the present study made a between-groups comparison of the frequency of maternal attributions of communication (SFMAC) and explanatory models predicting these

frequencies. Secondly, within-group analyses were carried out to investigate whether maternal and infant factors that the participants brought to the interaction predicted the types of the behaviors mothers called communicative. Finally, the mothers' roles of eliciting and responding to these communicative behaviors were explored. The following section discusses each major finding of the project. In so doing, relevant data from other studies are included to support or refute possible interpretations.

The major findings were as follows: 1) There were group differences in the total occurrence of three of the four potentially communicative infant behaviors. 2) There was no group difference in the frequency of maternal attributions of communication to their own children's behavior (SFMAC). 3) The groups required different explanatory models that predicted the respective levels of frequency of maternal attributions (SFMAC). 4) There was a positive within-handicapped group relation between degree of handicap and general maternal tendency to attribute (GMTAC). 5) There was a positive within-handicapped group relation of general maternal tendency to attribute (GMTAC) and two variables indexing type of communicative infant behaviors. 6) There were several within-handicapped group relations between degree of handicap and variables indexing type of communicative infant behaviors. 7) There was a relation between presence or degree of handicap and the types of maternal elicitations of communicative behaviors. 8) There was a positive within-handicapped group relation between degree of handicap and maternal responsiveness to communicative behaviors.

Interpretation of the Results

Finding 1: There were group differences on the total occurrence of three of the four potentially communicative infant behaviors. Infants in the handicapped group emitted fewer instances of gazes to toy, less coordinated attention to toy and mother, and a longer total duration of vocalizing during the 20 minute free-play session. The data regarding the handicapped group's lower levels of attention to toy and coordinated attention to mother and toy correspond to both theoretical and empirical developmental literature. Bruner (1975) proposed that infants from birth to five months attend mostly to their mothers during their waking moments; infants from four to eight months attend mostly to toys; and infants eight to eleven months coordinate attention to mother and to toy. This sequence has been widely accepted (Bakeman & Adamson, 1984; Uzgiris, 1981). A recent longitudinal study of six- to 18-month-olds playing with their mothers supports the age effect for increasing instances of initiations to toys and coordinated attention to mother and to toy (Bakeman & Adamson, 1984). Therefore, the group differences in the relative frequency of gazes to toy and coordinated attention may reflect the sequence of normal development of attention to toys and people.

This may not be the case with respect to the relatively high level of vocalizations in the handicapped group. The higher level of vocalization reflected the relatively high level of crying in the handicapped group (Kasari, 1985). Other studies have also found more negative affect in samples of atypical infants (Beckwith, Cohen, Kopp, Parmelee, & Marcy, 1976; Divitto & Goldberg, 1979; Field, 1977).

However, Adamson & Bakeman (in press) found increasing levels of affect and vocalizing with increasing age. Therefore, the higher level of crying found in the handicapped group in the present project may reflect the effects of a handicap, not developmentally young behavior. For example, pilot data on two of the most severely handicapped infants in the sample indicated much crying that was associated with the frequent activation of abnormal reflexes (Yoder & Farran, in press).

To test whether crying was communicative in the handicapped sample, the communicative segments of four handicapped infants who had the most communicative segments with vocalizations were re-analyzed. Less than six percent of the total number of these subjects' communicative segments contained an instance of crying. Two of the subjects had no instances of crying that were considered communicative by their mothers; one had one instance. The remaining subject had only five instances of crying out of 48 total communicative segments (9.6% of total number of segments, 19% of number of segments with vocalizations). Therefore, cries were not usually identified as communicative by mothers of the handicapped infants.

In fact, this higher level of negative affect creates obstacles in mother-infant interaction. Yoder and Farran (in press) found that relatively high levels of crying that interrupted mutual play was associated with relatively low levels of maternal responsiveness and total duration of mutual play. In contrast, high levels of gazes to new toys that interrupted mutual play was associated with high levels of maternal responsiveness and total duration of mutual play. In the present sample, the total occurrence of gazes to toy and vocalizations

were negatively related (Spearman's r = -.68, p = .004) suggesting that infants who cried frequently looked at toys infrequently. Yoder and Farran and others (e.g., Farran and Haskins, 1980) have defined maternal responsiveness as instances of responding to behaviors that researchers interpret as communicative. On the basis of Yoder and Farran's data and the group differences in potentially communicative infant behaviors, one would expect the mothers of handicapped infants to be less responsive than the mothers of the nonhandicapped infants. This was not the case.

Finding 2: There was no group difference in the frequency of maternal attributions of communication (SFMAC). "No difference" findings must be approached with caution. There are two general explanations for a "no difference" result (Cook and Campbell, 1979). There may be a true difference, but the study was not designed well enough to find it. Or there may, in fact, be no group difference on the variable of interest. One cannot be certain which explanation is operating in any one study. It is reasonable, however, to review the common causes for a type II error to informally estimate the probability that such factors may have been in operation in the study at hand. For example, the statistical procedure may not have been sufficiently powerful to detect a true difference with the small sample size (N = 32) used in this study. However, this seems unlikely since the means and standard deviations of the groups were so similar.

On the other hand, if there were no true group differences in the frequency of maternal attributions, then these results do not support the assumption that mothers of handicapped children are less responsive because their babies' give them fewer communicative cues (Dunst, 1983).

It is suggested here that mothers of handicapped children compensate for their infants' relatively low level of clear communicative cues by eliciting, searching for, and interpreting even relatively subtle cues. This interpretation is supported by the data discussed in the next three sections.

Finding 3: The groups required different explanatory models that predicted the respective levels of frequency of maternal attributions (SFMAC). The results indicated that the infant behavior factor was a significant predictor of SFMAC in the nonhandicapped group only. That is, the relatively high levels of gazes to toy and coordinated attention did not result in mothers of nonhandicapped infants attributing communication more frequently than mothers of handicapped infant because the relative frequency of presenting infant behaviors was not related to SFMAC in the handicapped sample. So what does account for the comparable level of maternal attributions in the handicapped sample? There are three sets of findings that support viewing the general maternal tendency to attribute communication factor (GMTAC) as important in understanding maternal attributions to their children's behavior in the handicapped group.

First, in the handicapped sample, there was a suggestive trend toward a positive relation between GMTAC and SFMAC despite the absence of a covariate to reduce the error term. In the context of the other findings in the study, this suggestive relation is worthy of further investigation. For example, in contrast to the handicapped group, GMTAC showed almost no relation to SFMAC in the nonhandicapped group despite the presence of a significant covariate. This pattern of results,

together with the small sample size used to test the significance of the relation, suggests that it is the mothers of handicapped children who have the greater role in determining when their infant communicates. This finding corresponds with other literature that has described the relation of a handicap or pre-maturity to increased interactive burden on these mothers (Beckwith, et al., 1976; Divitto & Goldberg, 1979; Field, 1977).

It may be that the mothers of severely handicapped children, in an effort to interact responsively to their babies' needs and wants, search for and interpret even very subtle cues. It is reasonable to assume that development brings increased clarity of communicative signal. Therefore, one may assume that severely handicapped infants give their mothers relatively more subtle cues. To maintain a high level of responsiveness, mothers of severely handicapped infants may have compensated for the subtly of their babies' cues by showing an increased general tendency to attribute. This notion would be supported by a positive relation between degree of handicap and general maternal tendency to attribute (GMTAC). This relation was found.

Finding 4: In the handicapped group, the mothers' general tendency to attribute communication to standard scenes of an unfamiliar infant (GMTAC) was positively related to the severity of their own infants' handicap. That is, the mothers of the severely handicapped children rated standard scenes of an unfamiliar baby's behavior as more communicative than did mothers of less severely handicapped infants. It is reasonable to assume that the greatest variance of mothers' ratings of the standard scenes would occur on items depicting relatively weak

infant communicative signals. Therefore, this finding may suggest that these mothers of severely handicapped children showed a greater general tendency to attribute communication to weaker signals.

The fact that these two variables were measured in separate contexts using a standardized format strengthens the claim that mothers of handicapped infants are affected by their infants in ways that endure beyond the interaction. That is, a maternal characteristic that was measured apart from the handicapped infants' presence was associated to an infant characteristic that was measured apart from the mothers' presence. This supports the notion that, at least in the handicapped sample, the mothers' general tendency to attribute communication (GMTAC) is a learned characteristic that is influenced by the degree of infant motor handicap. A decade of research has shown that mothers and infants influence each other during the interaction (see Osofsky and Connors, 1979 for review). In addition to this literature, finding #4 supports the notion that mothers and infants influence each other in ways that endure outside the interaction. To fully understand the affect that mothers and their handicapped infants have on each other, researchers need to investigate the interrelation of maternal and infant variables within and outside of the mother-infant interaction.

Evidence that mothers carried this general tendency to attribute to weak communicative signals over to actual interaction with their own children would support the notion that this learned maternal characteristic, in turn, influences the types of behaviors mothers of handicapped infants called communicative. This evidence was found.

Finding 5: In the handicapped sample, the mothers' general tendencies to attribute (GMTAC) was positively related to two variables indexing the types of the behaviors they called communicative in their own children. GMTAC not associated with any measure of the nature of communicative behavior in the nonhandicapped sample. The inclusive category of "the proportion of communicative segments with attention to mother" and the combined behavior category of "attention to mother and to toy" were positively associated with GMTAC in the handicapped sample. That is, the more freely the mothers of handicapped infants attributed, the more frequently they identified communicative segments with attention to mother when it was accompanied by attention to toy. It is argued here that instances of attention to mother that may be considered "weak" or "subtle cues" were combined with attention to toy.

To explain how attention to mother and to toy may have been a subtle signal in the handicapped sample, two more pieces of information about the nature of these behavior clusters is provided. First, in the handicapped sample, the combined behavior category of "attention to mother and toy" did not measure instances of the developmental milestone coordinated attention to mother and toy. Neither the critical criteria of active engagment with mother and object nor temporal proximity of attention to mother and to toy was required when coding whether attention to mother and to toy occurred sometime during the communicative segment. In fact, there was no relation between the proportion of segments with attention to toy and mother and the overall frequency of coordinated attention in the handicapped sample (Spearman's $r = -.26$, $p = .35$). An informal analysis of the communicative segments

with attention to mother and to toy indicated that many of these involved the infant's gaze momentarily fixing on mother's face while "absent-mindedly" holding an object. That is, no evidence of coordinated attention between the object and mother was present in most of these segments. Together, these finding support the notion that coordinated attention and segments with attention to mother and to toy index different behaviors in the handicapped sample. Second, on the average, two behavior types were combined in the handicapped group's communicative segments ($\underline{M}$ = 1.69). That is, instances of attention to mother rarely occurred alone; no subjects had more than one segment with attention to mother occurring without a vocalization or attention to toy. Those accompanied by attention to toy usually occurred without the additional occurrence of a vocalization; all but the most mildly handicapped subject had only two or fewer segments in which vocalization co-occurred with attention to toy and mother. This is important because attention to mother and to toy may have been relatively subtle without the accompanying presence of a vocalization to call the mothers' attention to their children or mark their behavior as having changed in some meaningful fashion.

As mentioned earlier, the number of segments mothers of handicapped infants called communicative was negatively related to the proportion of segments with attention to mother and to toy and to those with attention to mother, but without a vocalization. These findings are consonant with the conclusion that attention to toy and to mother in the handicapped sample was a subtle signal of the child's interests and feelings. The negative relation can be explained if one assumes that the infants with

a high proportion of segments with attention to toy and mother, without a vocalization, emitted few other, perhaps more clear, cues. In the absence of clear cues, their mothers interpreted these subtle cues, but did so infrequently.

This finding represents a case where a maternal characteristic that was measured at a different time, in a different context, and using a standard format (i.e., GMTAC) was associated with the mothers' behavior during the interaction (i.e., SFMAC). This contrasts with the failure of other studies to find similar associations (e.g. Monahan, 1975 as cited in Cairns, 1978). The discrepancy may lie in the nature of the maternal characteristic that is studied (Cairns, 1978). The present study measured an independent maternal characteristic (GMTAC) that, logically, is directly related to the maternal behavior measured during interaction (SFMAC). In contrast, Monahan (1976) measured general personality characteristics (e.g., warmth, control, and dependency) and tested the relation of these characteristics to very specific maternal behaviors during interaction (e.g., orienting to the infant, talking, and mutual visual regard). The global characteristics in Monahan's study simply may not be relevant to specific behaviors.

In the nonhandicapped sample, GMTAC may not have been related to the types of behavior that mothers called communicative because the types of behaviors that these mothers interpreted as communicative were relatively strong cues. This is supported by the regression model for the frequency of maternal attributions (SFMAC) in the nonhandicapped sample. The frequency of maternal attributions (SFMAC) were predicted by the relative occurrence of coordinated attention, a strong cue. That is,

in the nonhandicapped sample, the frequency and nature of the infants' behavior is the more important factor in predicting frequency and occurrence of maternal attributions of communication.

In contrast, it appears that mothers of severely handicapped children bare more of the burden for deciding the frequency and occurrence of maternal attributions of communication. This may be due to relatively high proportion of subtle communicative cues that severely handicapped children give their mothers to interpret. However, this is not to say that all handicapped infants in the sample gave their mothers only weak signals. The next finding indicates what types of behaviors were called communicative by mothers of infants with various levels of handicap.

Finding 6: There were several within-handicapped group relations between degree of handicap and variables indexing the types of communicative infant behaviors. The severely handicapped children had more communicative segments with attention to mother and vocalization and fewer with only attention to toy. This within-handicapped group data corresponds to the pattern of results revealed in the between-group comparison of the relation of the nature of the communicative segments to the overall occurrence of infant behaviors.

In the section discussing the relation of the nature of behaviors mothers called communicative to the overall occurrence of infant behavior, the data suggested that communicative segments in the nonhandicapped sample focused around toys. However, nonhandicapped infants combined attention to toy with vocalizations or with attention to mother before their mothers considered these behaviors communicative.

Many of the nonhandicapped infants' gazes to mother during the free-play session were called communicative because they were coordinated with attention to toy. In contrast to those in the handicapped group, the proportion of segments with attention to mother and toy in the nonhandicapped group was positively related to the overall occurrence of coordinated attention (Spearman's r = .58; p = .03) suggesting that, in the nonhandicapped group, these scores reflect similar behaviors and that mothers considered these communicative.

In contrast, it appears that communicative segments in the handicapped sample focused around mothers. In the handicapped sample, the proportion of segments with attention to toy reflected the overall frequency of gazes to toy suggesting that many mothers of handicapped children considered directed attention to a toy sufficient to be considered as communicative. Perhaps, as the group data on the overall occurrence of gazes to toy indicated, this is because attention to toy was relatively infrequent in the handicapped sample. For example, one mother of a handicapped child called her infant's gazes at a toy communicative. Additionally, handicapped infants combined attention to mother with vocalizations before mother usually called eye contact communicative.

As mentioned in the discussion of the group differences on these infant behaviors, the greater proportion of segments with attention to toy in mildly handicapped infants reflects the increasing interest that infants show in toys as they develop (Bakeman & Adamson, 1984; Uzgiris, 1981). Likewise, the relatively large proportion of segments with attention to mother and vocalization in severely handicapped infants may

reflect the early face-to-face, verbal turn-taking that very young infants and their mothers spend so much time doing (Fogel, Diamond, Langhorst, and Demos, 1982; Uzgiris, 1981). Indeed, an informal analysis of the severely handicapped infants' communicative segments with attention to mother and vocalization indicated that many of these were actually continuous vocalizations that occasionally coincided with a gaze at the mother's face. Regardless, the mothers almost without exception, inserted their responses into pauses; this resulted in an engagement that resembles early vocal turn-taking. These face-to-face interactions have been described as the earliest context in which infants learn to act in a responsive, increasingly more reciprocal fashion (Fogel, et al., 1982; Kaye, 1982).

Instances of attention to mother and vocalization are not necessarily less salient to mothers than instances of attention to toy. It is suggested here that these types of mother-infant engagement are developmentally younger. However, high levels of attention to objects have been found to be associated with relatively high levels of maternal responsiveness and relatively longer time spent in joint attention to a common focus (Yoder & Farran, in press). Additionally, it can be argued that more diverse meanings can be glossed from interactions involving objects than is possible from interactions that exclude them. Therefore, it may be that although attention to mother and vocalization is as salient as attention to toy, the early form of face-to-face interactions do not provide mothers with as much information about the infants' increasingly more complex wants, needs, and interests. The maternal role in facilitating the shift from predominantly face-to-face interactions

to increasingly more object-oriented exploration is particularly important (Kaye, 1982). The next section describes the frequency and nature of the maternal elicitations of the behaviors they called communicative.

Finding 7: There was a relation between presence or degree of handicap and the nature of maternal elicitations of communicative behaviors. Mothers of both groups elicited over half of the behavior clusters they called communicative. However, the more handicapped the infant, the more the mother physically prompted the infant's actions. In contrast, the nonhandicapped mothers used more elicitations using only spoken prompts, a prompt that carries a low obligation to comply. This finding was expected. The more physically handicapped the infant is, the more facilitative positioning and physical prompting the infant needs to act in a directed fashion. In contrast, the nonhandicapped 11-month-olds were able to locomote, orient, position and act independently. These data correspond with the normal developmental literature that reports that a) as infants develop, they respond to increasingly more distal stimuli (Lewis and Ban, 1971) and b) as infants develop, mothers use increasingly more distal prompts (Beckwith, 1971, Lusk and Lewis, 1972). Therefore, it appears that the mothers' level of assistance reflected their infants' level of need.

Interestingly, despite the fact that mothers of the severely handicapped infants often provided maximum direction to their infants' actions, they called their babies' behavior communicative. It appears that these mothers were sensitive to very subtle evidence that their infants were acting out of their own volition, or at least not resisting

the mothers' assistance, and called these directed behaviors communicative. Anecdotal evidence from the present study's sample provides an example. One mother of a very severely handicapped infant frequently positioned the infant in her lap in a such a way that he was highly likely to gaze at the mother. The infant vocalized continuously. Whenever his fleeting gaze rested on her face, she indicated communication had occurred and responded accordingly.

Finding 8: There was a positive within-handicapped sample relation between degree of handicap and maternal responsiveness to communicative behaviors. The mothers in both groups responded to almost all of the behaviors they called communicative (grand M = 89%). This finding supports the construct validity of the subjective measure of the frequency of maternal attributions. The theory on which the measure was based predicted that mothers would respond to the behaviors they called communicative. Harding (1984) and Lawrence (1984) also found a high level of responsiveness to behaviors mothers called communicative.

However, the mothers of the severely handicapped infants responded more frequently to their infants' communicative behaviors than did mothers of less severely handicapped infants. This finding does not support the assumption that mothers of handicapped infants are less responsive than mothers of nonhandicapped infants (Dunst, 1983). It has generally been suggested in the literature that this alleged lower level of responsiveness is due to fewer attributions of communication (Goldberg, 1977). These fewer attributions of communication are supposedly due to fewer and less interpretable infant cues (Dunst, 1983). As mentioned earlier, there were no group differences found in

the frequency with which mothers attributed communication. It was suggested that this may be explained, in part, by the finding that mothers of severely handicapped infants tend to attribute communication to even subtle cues. Once identified as communicative, it appears that these mothers responded to these cues at an even higher level than did mothers of less severely handicapped infants.

One explanation for the discrepancy between the findings of this and other studies concerning the responsiveness of mothers of handicapped infants lies in the different bases that researchers have used to decide when an opportunity to respond has occurred. For example, Yoder and Farran (in press) operationalized maternal responsivity as the number of times mother followed the child's lead. "A lead" can be thought of as a communicative signal. The occurrence of a communicative signal in Yoder and Farran's study was determined by the coder's judgment. In the present study, the occurrence of a communicative signal was determined by the mother's judgment. Perhaps, it is more ecologically valid to use the mother's judgment as the basis for determining when a communicative signal occurs because she has an interactive history with her child and thus the shared knowledge that is crucial for early pre-linguistic communication to occur (Newson, 1979). Utilizing this interactive history is even more important when dealing with handicapped infants because they may use more idiosyncratic and subtle cues (Dunst, 1983).

The different bases for determining when a communicative signal occurs may account for the discrepancy between the literature and the present study, but it does not explain why mothers of severely

handicapped children responded to more of the behaviors they called communicative than did mothers of less severely handicapped children. It may be that the mothers of severely handicapped infants have to be more actively involved with their infants to maintain an interaction. This can be seen in the greater directiveness shown in eliciting communicative signals and the more active role the mother must play in searching for and interpreting weak signals in their infants.

Alternatively, this finding may reflect the type of signals that these severely handicapped infants give to their mothers. As mentioned earlier, these infants show more instances of attention to mother that are accompanied by vocalizations and these are often interpreted as communicative. The nature of these earlier face-to-face interactions may reward and/or require an active maternal role to maintain the interaction. For example, in face-to-face interactions, mothers engage in much sensitive vocal, facial, and motoric turn-taking. (Fogel, et al., 1982).

A synthesis: The above section discussed the results as organized by the hypotheses and research questions that were particular to this study. This section summarizes the contributions of the present study to addressing questions of a more general nature. In so doing, the findings of the present study will be related to previous studies to address questions about a) the types of behaviors mothers call communicative and b) the effect that an infant handicap has on mother-infant interaction.

There has been some attempt in the literature to identify which infant behaviors are communicative (Beckwith, 1971; Harding, 1984;

Lawrence, 1984). Both the coders' judgment (Farran and Haskins, 1980; Harding, 1984) and the mothers' judgment (Lawrence, 1984) have been used to identify such behaviors. When considering individual infant behaviors, there is agreement that eye contact and vocalizations are often considered communicative in pre-linguistic infants (Harding, 1984; Lawrence, 1984). The present study supports this finding. However, this study does not support Lawrence's (1984) speculation that the number of communicative vocalizations increases with development. Handicapped infants had approximately equal numbers of communicative segments with vocalizations as did nonhandicapped infants. The present study indicates that communicative segments rarely contain just one behavior type, suggesting that combined behavior categories may be more accurate descriptors of communicative infant behaviors. Associations between developmental level and type of communicative behavior were most frequent with combined behavior categories. For example, severely handicapped infants' eye contact was most frequently considered communicative when it was accompanied by vocalizations. These findings correspond with others' data (Als, Lester, Tronick, and Brazelton, 1982; Fogel, et al, 1982) that one form of early communication is characterized by attention to mother combined with vocalizations. In contrast, the more developmentally advanced nonhandicapped infants' eye contact was usually coordinated with attention to toy when mothers considered it communicative. These data correspond with others' data (Bakeman and Adamson, 1984; Harding and Golinkoff, 1979; Harding, 1984) in suggesting that mothers of more developmentally mature infants identify more instances of coordinated attention as communicative. Taken

together, the above data suggests that researchers' and mothers' criteria for determining what infant behaviors are communicative change with age (Beckwith, 1971; Harding, 1984).

An added complication to determining which infant behaviors are communicative on an a priori basis is the inappropriateness of applying generalizations to individual dyads. There are several reasons why such an application is inappropriate. First, generalizations based on group data may not represent what is communicative in an individual dyad. In fact, Lawrence (1984) found evidence for three subgroups based on the types of infant behaviors presented to and interpreted as communicative by their mothers. Second, although appropriate for the research questions that these variables were designed to address, descriptions of communicative behaviors given in the present and previous studies are usually too general to predict the exact form of behaviors in a specific dyad. This is particularly true in dyads with handicapped infants who may give idiosyncratic signals to their mothers. Third, the nature of pre-linguistic communication is to some extent a subjective phenomenon. As indicated by the present data, the mothers' general tendency to attribute communication is an important factor in predicting the frequency and nature of maternal attributions to behaviors of handicapped infants. Therefore, any attempt to determine in an a priori fashion which behaviors a mother of a handicapped child will or should call communicative will be futile because a priori definitions of "communicative infant behaviors" can not take into account the mothers' contribution to defining what is communicative.

A second major question the present study addresses is the effect of an infant handicap on mother-infant interaction. This was studied at two general levels. a) There was an effect of infant behaviors associated with the presence or degree of handicap on maternal behaviors during an interaction. Specifically, the relation of mothers' eliciting and responding behaviors to the occurrence of an infant communicative behavior was investigated. b) There was an effect of a handicap as an independent infant characteristic on a maternal characteristic that endures beyond a specific interaction. Specifically, the relation of a summary score indexing degree of handicap to a summary score indexing the mothers' general tendency to attribute communication (GMTAC) was investigated.

The most common way to study the effect of an infant handicap on mother-infant interaction is to describe the interaction of dyads with handicapped infants and compare this with the interaction of dyads with nonhandicapped infants. The present study indicates two ways that the behavior of mothers of severely handicapped infants differed from the behavior of the mothers of less handicapped infants. The mothers of severely handicapped infants used more proximal elicitations and responded to more communicative behaviors than did mothers of less handicapped infants. The first finding corresponds to the developmental literature about the behavior of mothers of very young nonhandicapped infants (Lusk and Lewis, 1972). The second finding conflicts with theoretical literature that claims mothers of handicapped infants are less responsive than other mothers (Dunst, 1983). As was discussed earlier, this discrepancy may be present because past theoretical and

empirical literature has depended on the coder's judgment of when a communicative cue occurs; whereas, the present research utilized the mother's judgment of when such a cue occurs.

There has been very little investigation of the effect of an infant handicap on relatively stable maternal characteristics which are assumed to relate to mother-infant interaction. The present data indicate that degree of infant handicap was positively related to the handicapped mothers' general tendency to attribute communication. In turn, this maternal characteristic was related to the types of behavior mothers of handicapped children called communicative in the interaction. No previous studies have investigated the effect of a handicap on this specific maternal variable. However, some studies that have utilized this general approach of studying the effect of an infant handicap on maternal characteristics have investigated maternal depression (Burden, 1980; DeMyers, 1979) and stress (Holroyd and McArthur, 1976). It should be noted that these studies did not measure whether the levels of maternal depression or stress were related to any aspect of mother-infant interaction.

Alone, the above approaches to studying the effect of an infant handicap on mother-infant interaction will offer an incomplete and over-simplified picture. Stoneman and Brody (1984) have suggested a combined use of these two approaches. The present project is representative of such an effort. The result is a more complete picture of how an infant handicap may affect mother-infant interaction. When seen as a whole picture, the present study's results support a view of interaction with handicapped infants in which the mother's role is

increasingly larger and more active as severity of infant handicap increases. Specifically, the mother may use whatever prompts are needed to get the infant to show attention to a toy or to herself. These prompts often involve physically positioning or literally moving the infant's hand to touch an object. Despite these very directive prompts, the infant gives cues typical of the developmentally young , which are often restricted in possible meaning and are often quite subtle. For example, the infant's usually unfocused gaze may momentarily fix on the mother's face while holding an object. Despite the paucity of information that these developmentally young cues give the mother, she interprets many of these as communicative. She may do so because her interactive history with her child has taught her to search for and interpret even very subtle cues in an effort to act responsively to her baby's interests and feelings. This heightened sense of involvement may result in a very high level of responsiveness to these cues.

Caveats. The extent to which it is reasonable to generalize the present results is limited by the nature of the sample used. Two characteristics of the sample are particularly noteworthy: a) limited variance in socioeconomic status in both groups and b) inclusion of a variety of infant handicaps in the handicapped group.

The majority of the dyads in both groups were in the middle socioeconomic level. Therefore, the results should not be generalized to dyads of other SES levels. SES affects several aspects of mother-infant interaction (Farran, 1982). For example, middle class mothers talk more frequently to their infants than do lower class mothers (see Farran, 1982 for review). Therefore, SES may prove to

interact with the pattern of results concerning the relation of degree of handicap and type of elicitation used or proportion of maternal responsiveness to communicative behaviors.

The composition of the handicapped sample prevents clear statements about the effect of various types of handicaps on mother-infant interaction. The handicapped sample used in the present study excluded infants with hearing and visual impairments. Sensory handicaps may affect mother-infant interaction in different ways than other handicaps. For example, the typical form of communicative behavior of a blind baby is quite different from that of a Down syndrome baby (Fraiberg, 1977). The only types of handicaps included in the present sample were motor and mental handicaps. Motor handicaps and mental handicaps may also differ in the ways they affect mother-infant interaction. For example, motor impairments affect the clarity of communicative signals (Dunst, 1983) and mental impairments delay the acquisition of cognitive skills (Sameroff and Cavanagh, 1979) that may underlie coordinated and symbolic forms of communication (Harding and Golinkoff, 1979). Unfortunately, the size and composition of the present sample was not sufficiently large nor sufficiently homogeneous to allow teasing out the effects of these two types of handicap. It should be noted that although the measure for degree of handicap was a measure of motor handicap (MAI), the scores on this instrument were very highly correlated with those on the measure of infant cognition (Bayley MDI). Therefore, the present data should be interpreted as indicative of the combined effects of motor and cognitive impairments on mother-infant interaction.

Suggestions for Future Research

The above section discussed what contributions the present study made to the literature. This section discusses some of the unanswered questions. In so doing, some of the alternative explanations to the present results will be discussed.

Although a discontinuous analysis sufficiently addressed the research questions posed for this study, some remaining unanswered questions which involve conditional probabilities require a contingency study that analyzes the mothers' and infants' behavior during the entire free-play session. Some of these questions are a) Is the conditional probability of an attribution occurring after a certain target behavior greater than chance? That is, what behaviors have the strongest communicative value at specified ages? b) Are the conditional probabilities of these communicative behaviors occurring after a certain type of elicitation greater than chance? That is, what elicitations are effective at eliciting these communicative behaviors. c) Is the conditional probability of a maternal response occurring after a communicative behavior greater than chance? The answer to this last question is essential to understanding if maternal attributions of communication are as important as the literature has suggested in motivating maternal responses to infant behavior. If mothers respond to noncommunicative behaviors as much as communicative ones, then maternal attributions may be an unnecessary part of the developmental theory.

To test whether maternal attributions of communication may have a developmental role, a longitudinal study is required. That is, one could test whether levels of maternal attributions of communication to their

infants' pre-linguistic behaviors is associated to later levels of linguistic development. A longitudinal design could also address whether the comparable frequency with which mothers of handicapped and nonhandicapped children attributed communication holds up over time. That is, since mothers of handicapped children carry the greater burden of the interaction for a longer period of time than other mothers, these mothers may eventually tire of this burden resulting in the eventual reduction in the frequency with which they attribute communication?

The effect of infant age on various aspects of the mother-child interactions could also be addressed in a cross-sectional design. For example, one could test if the results associated with presence or degree of handicap in this study are similar to those seen in mothers interacting with their younger infants? Specifically, do the behaviors that mothers of young infants call communicative resemble those found to be associated with degree of handicap in this study? Does the maternal tendency to attribute factor become important in predicting the frequency of maternal attributions if the nonhandicapped infants are younger than those in present study? Are the types of elicitations used by mothers of younger nonhandicapped children similar to those used by the mother of handicapped infants in the present study? Is the level of maternal responsiveness to communicative behaviors of younger nonhandicapped infants similar to that of the mothers of severely handicapped infants in the present study?

All of the above suggested studies are observational, that is, no experimental manipulation is made. Therefore, there exists the possibility that the direction of effect is other than that hypothesized

(Bell, 1968; Belsky, Goode, & Most, 1980). The same is true of the results of the present study. However, conclusions about the direction of effect of variables in observational studies are more plausible when a) one direction of effect is implausible and b) the temporal antecedence of one variable is known (Cook & Campbell, 1979). For example, assuming a causal relation among variables, it is implausible that maternal tendency to attribute or various types of behaviors caused the infants' degree of handicap because the etiology of these handicaps were biological and present at birth. However, it is acknowledged that the plausibility of an explanation for results of an observational study is influenced by the present trend of the literature. Witness the years of acceptance that mothers were the primary, if not only, influences in mother-infant interaction (Bell, 1968). Therefore, it is possible, although unlikely, that several of the relations found in the present study reflect a direction of effect other than hypothesized.

Apparent disagreements about direction of effect may reflect differences in the level at which one is trying to explain causality (Cook & Campbell, 1979). For example, it is possible that at an interactional level maternal tendency to attribute affects the frequency of attributions that a mother of a handicapped child makes during one interaction. But it is also possible that, over time, the more frequently the mother makes attributions to her own child's behavior, the more familiar attributing to pre-linguistic behaviors become and thus the higher her tendency to attribute to other babies' behavior. There is no real disagreement here, just a different level of explanation. Therefore, note that when the research question involves at

least one variable which was based on the free-play session, the level of explanation offered in the above section is at the interactional level.

An experimental study would be helpful in determining if the associations between variables in the present and suggested studies reflect causal relations. Without such studies, the relation among variables may be indirect or spurious (Cook & Campbell, 1979). For example, it is reasonable to ask whether the relation of maternal tendency to attribute with the proportion of segments with attention to mother in the handicapped sample may have been a spurious one. However, the data do not support such a conclusion. As indicated in the Results section, both maternal tendency to attribute and degree of handicap were associated with the proportion of segments that show attention to mother. However, degree of handicap was positively associated with the proportion of segments with attention to mother accompanied by a vocalization. In contrast, the maternal factor was positively associated with the proportion of segments which contained attention to mother accompanied by attention to toy.

A final suggestion concerning the refinement of the model which motivated the present study is to address questions about the effect of the timing and developmental appropriateness of the nature of certain maternal behaviors during an interaction. For example, professionals who work with parents of handicapped children need to know more about when in an interaction an elicitation is most helpful and what types of elicitations are most developmentally appropriate for a specific type of child. Likewise, researchers should consider the nature of the responses

mothers give to their children's behavior and determine the differential efficacy of these responses to maintaining interaction and facilitating infant development.

Educational Implications of the Present Study

Sensitive and effective intervention with parents of handicapped children requires that professionals understand the bidirectional effect of mother and infant on each other. The results of this study supports the notion that neither partner of the interaction acts independently of the other. This influence is seen during and beyond the interaction. During interaction, the mothers of severely handicapped children may have used elicitations which provided more direction for their infants because their infants needed this high level of direction. Beyond the interaction, months of interaction with their severely handicapped children may have taught the mothers to attribute communication more freely than do other mothers. Such a bidirectional view helps professionals to view abnormal development accurately and avoid placing blame on the mother for interactive differences which may be adaptive.

Professionals should critically analyze common assumptions about how parents of handicapped children typically act. These assumptions may be incorrect, or they may fail to characterize specific parents. The results of this study challenge the assumption that mothers of handicapped children are less responsive than other mothers. Therefore, clinicians should use an empirical approach to determining if mothers are, in fact, interpreting their babies' behavior as communicative and responding to this behavior.

Summary of the Study

The literature has suggested that maternal attributions of communication may motivate mothers to respond to their babies' behavior contingently. This contingent responding affects the nature of mother-infant engagements and may facilitate infant development. Some researchers have suggested that mothers of handicapped infants respond to their infants' behavior less frequently than other mothers. One explanation for these differences has been the assertion that handicapped children give their mothers fewer communicative cues.

The present study addressed several questions about the frequency and nature of maternal attributions of communication in dyads with 11-month-old handicapped infants (n = 16). Although a sample of dyads with chronological age matched peers without handicaps (n = 16) was included for comparison, the main thrust of the study was to investigate the relation of variables within the handicapped group. The purposes of the study were a) to compare groups on the frequency of maternal attributions of communication, b) to compare explanatory models for within-group variance on frequency of maternal attributions, c) to test the relation of infant and maternal factors on the types of behaviors that mothers of handicapped children called communicative, and d) to describe the maternal elicitations and responses to these behaviors.

It was found that, despite the finding that mothers of severely handicapped infants used more directive prompts to elicit behaviors they called communicative, their infants gave them developmentally young, less diverse, and less informative cues. Despite the predominance of less informative cues, mothers of handicapped children attributed

communication with comparable frequency to that of mothers of nonhandicapped infants. This was explained by the finding that as severity of infant handicap increased, the mothers tended to compensate for the paucity of information in their infants' cues by attributing communication more freely. The greater importance of the mothers' role in attributing communication in the handicapped sample was accompanied by an increased frequency with which mothers of severely handicapped infants responded to communicative behaviors.

It was noted that these results challenge the assumption that mothers of handicapped children respond less frequently to their infants. One explanation for the discrepancy between the present results and those in the literature lies in the definition of the opportunity for a maternal response. Past studies have relied on the coder's judgment for when an infant communicative signal is given. In contrast, the present study relied on the mother's report for when a communicative signal is given. This latter option is seen as a desirable alternative because it utilizes the mother's interactive history to decide what possibly subtle or idiosyncratic behaviors are communicative. Indeed, in light of the present results, it appears that pre-linguistic communication in dyads with handicapped infants is, in part, a subjective phenomenon in which the mothers' general tendency to attribute is particularly important when predicting the frequency and nature of maternal attributions of communication.

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APPENDIX A

Name: _____ ID#: _____ Visit: _____ Coder ID#: _____

OS3	Time: Min. and Sec.	Time: Relevant Segment	Most Salient Beh.: Target: Attn. to Object	Most Salient Beh.: Target: Attn. to Mother	Most Salient Beh.: Target: VOCS	Most Salient Beh.: Other: Facial Expression	Most Salient Beh.: Other: Other	Elicitation: VOC	Elicitation: Manipulate Object	Elicitation: Physical Prompt	Elicitation: Other	Maternal Response
8"-20"		8"-10"		*B			✓	✓				✓
30"-51"		32"-35"	B	✓				✓	✓			✓
54"-62"	:34-1:02	:53-1:06		✓	B			✓	✓			
74"-80"	1:14-1:23	1:14-24		✓	B			✓		✓		✓
82"-83"	1:22-1:23				B		✓			✓		
83"-87"	1:23-1:27	1:27-1:29		B	B		✓			✓		✓
87"-90"	1:27-30	1:29-1:30		B	B		✓			✓		✓

* "B" indicates which behavior began the segment. This information was not used because sufficient inter-observer reliability was not obtained.